

TM 5-4520-233-14

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

RETURN TO GOVERNMENT

**OPERATOR, ORGANIZATIONAL, DIRECT AND GENERAL
SUPPORT MAINTENANCE MANUAL**

**HEATER, SPACE, MULTI-FUEL, WITH BLOWER,
60,000 BTU/HR (HUNTER MODEL UH-68D)
FSN 4520-114-1055**

This copy is a reprint which includes current
pages from Changes 1 through 3.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JUNE 1969

SAFETY PRECAUTIONS

BEFORE OPERATION

Do not install the heater in an enclosed area unless the exhaust gases are piped to the outside. Inhalation of exhaust fumes will result in serious illness or death.

Do not operate a leaking heater. Repair leaks and clean up spilled fuel before starting heater operations. Operating a leaking heater may result in fire or explosion.

Do not use fuel with a rating exceeding 100 octane.

Do not smoke while handling or dispensing fuel. Do not handle or dispense fuel around an open fire or flame.

Disconnect the electrical supply from the heater before connecting or disconnecting the room thermostat. Dangerous voltages can exist at the thermostat if the electrical supply is not disconnected.

DURING OPERATION

The space heater contains dangerous voltages which can cause severe electrical shock or death. Be extremely careful when making voltage measurements or other checks with the heater connected to the power source during troubleshooting. Always remove the power plug before making any continuity tests.

Do not operate the space heater in a confined area without piping the exhaust gases to the outside. The exhaust gases contain carbon monoxide, a colorless, odorless, deadly poisonous gas.

AFTER OPERATION

Disconnect the electrical supply from the heater before connecting or disconnecting the room thermostat. Dangerous voltages can exist at the thermostat if the electrical supply is not disconnected.

During heater repair, never reinstall a heat exchanger which is cracked or has holes in it. This will allow combustion gases to contaminate circulating air. Since the combustion gases contain carbon monoxide, a deadly poison, this could result in illness or death of room occupants.

Change

No. 5-4520-233-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C., 24 February 1972

**Operator, Organizational, Direct And General Support Maintenance Manual
HEATER, SPACE, MULTI-FUEL; WITH BLOWER; 60,000 BTU/HR (HUNTER MODEL UH-68D)
FSN 4520-114-1055**

TM 5-4520-233-14, 6 June 1969, is changed as follows:

Page 1-3, paragraph 1-4a(1). Change serial number (range) from 10,002 through 10,501, to read 10,002 thru 11,381.

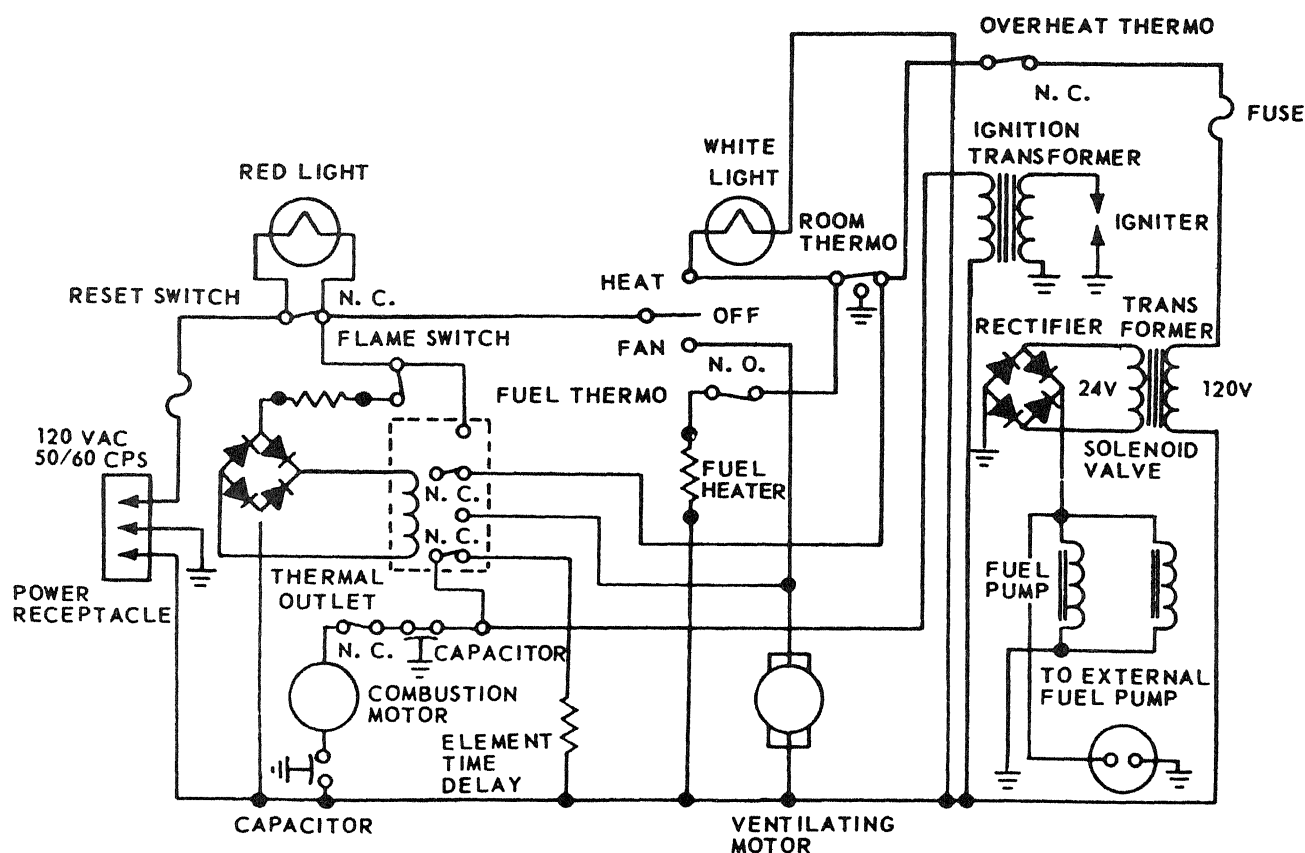
Page 1-4, paragraph 1-4b(6). Change Rev. per min from 115 to read 8000, and Volts from 60 to read 115.

Page 1-5, paragraph 1-4b(20). Change Rating to read "Open at $55^{\circ} \pm 6^{\circ}$ F, Close at $40^{\circ} \pm 6^{\circ}$ F."

Paragraph 1-5. Change serial numbers 10,002 thru 10,501, to read 10,002 thru 11,381.

Page 3-7, paragraph 3-14c(1), change "carburetor" to read "fuel pump".

Page 3-15. Figure 3-9 is superseded as follows:



ME 4520-233-14/3-9 C1

Figure 3-9. Electrical schematic diagram.

Page 3-21. Figure 3-18 is superseded as follows:

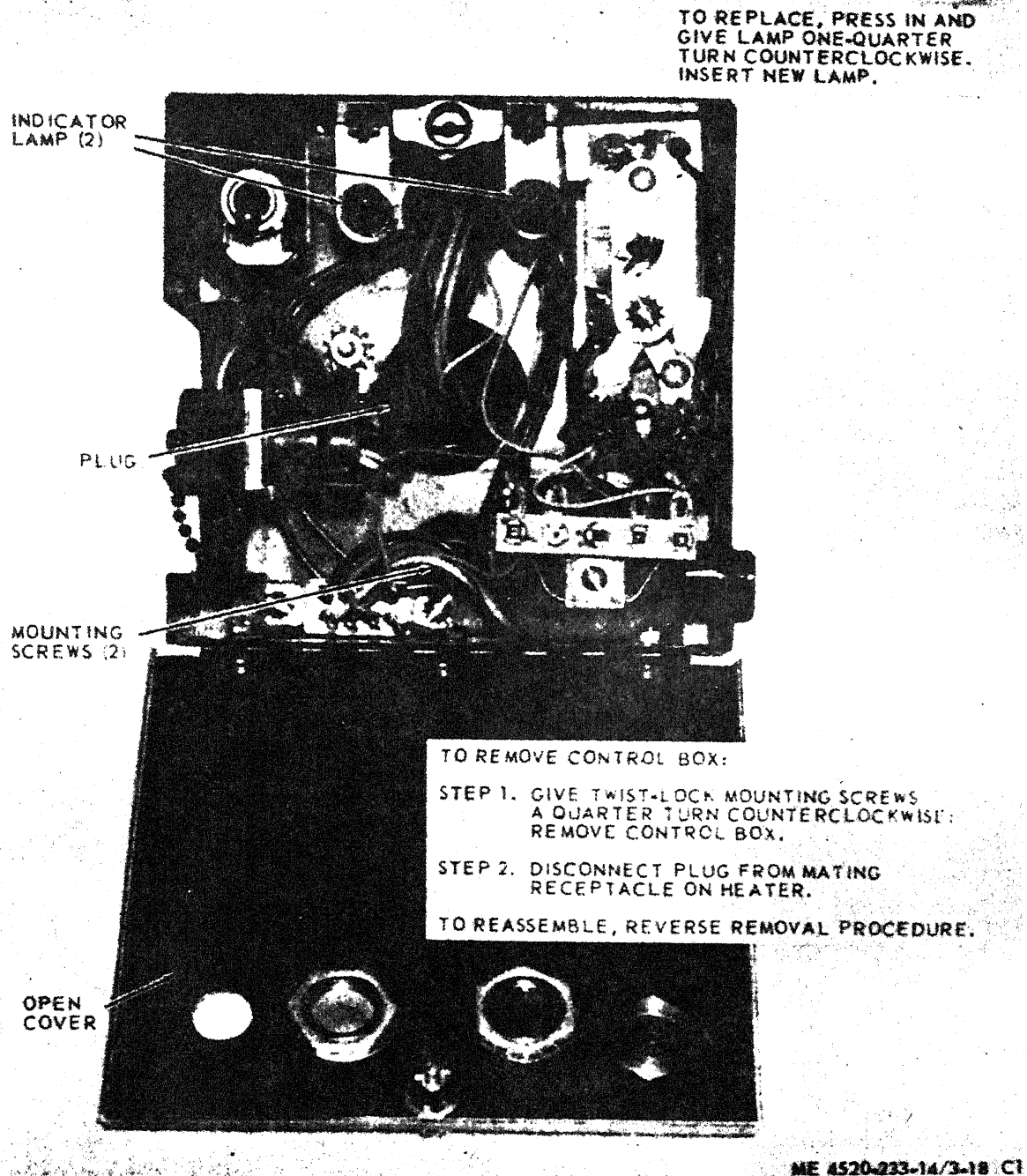
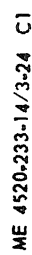


Figure 3-18. Replacing indicator lamps and control box removal.

Page 3-22. Figure 3-19 is superseded as follows:

4



Page 6-4, paragraph 6-4c, add paragraph (3.1) as follows: (3.1) Install circulating air motor and fan (paragraph 3-26).

Page B-1. Paragraph B-2a is rescinded.

Paragraph B-2b. Delete designation "b" and change "Section III" to read "Section II".

Page B-2. Section II, Basic Issue Items is rescinded.

Section III is superseded as follows:

Section III. MAINTENANCE AND OPERATING SUPPLIES

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required l/initial operation	(5) Quantity required F/8 hrs operation	(6) Notes
	9140-286-5283	Fuel Oil Diesel Federal Specification VV-F-800 Fuel Oil (DF-A)	As required	2 gallons	Military symbol DF-A. Arctic-grade diesel fuel oil is intended for use in high-speed automotive-type diesel engines and in pot-type burner space heaters, in areas where mean ambient temperatures lower than -25°F (-30.7°C) occur and where it is impractical to maintain fuel storage capabilities. This grade of diesel fuel should not be used for slow-speed stationary engine applications. Military symbol DF-1. Winter-grade diesel fuel oil is intended for use in high-speed automotive service in areas in which ambient temperatures as low as -25°F (-31.7°C) occur. This grade of diesel fuel may be used for medium-speed stationary engine applications, where fuel heating facilities are not available.
	9140-286-5286	Fuel Oil (DF-1)	As required	2 gallons	Military symbol DF-2. Regular-grade diesel fuel oil is intended for use in all automotive high-speed diesel engines and in medium-speed engine applications in areas in which the ambient temperatures are above 20°F (-6.7°C).
	9140-286-5924	Fuel Oil (DF-2)	As required	2 gallons	Military symbol DF-2. Regular-grade diesel fuel oil is intended for use in all automotive high-speed diesel engines and in medium-speed engine applications in areas in which the ambient temperatures are above 20°F (-6.7°C).
	9130-160-1818	Gasoline, Automotive Combat Military, Specification MIL-G-3056 Gasoline, Auto (Type I)	As required	2 gallons	Type I. Type I gasoline is intended for general use at all temperatures above 0°F.
	9130-160-1830	Gasoline, Auto (Type II)	As required	2 gallons	Type II. Type II gasoline is intended for use in areas where the mean temperature is consistently below 32°F.

By Order of the Secretary of the Army:

W. C. WESTMORELAND
General, United States Army
Chief of Staff.

Official:

VERNE L. BOWERS,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-25C, (qty rqr block No. 590) Organizational maintenance requirements for Heaters, Space, 60,000 BTU.

TM 5-4520-233-14
C 2

Change }
No. 2 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C., 19 April 1978

**Operator, Organizational, Direct and
General Support Maintenance Manual
HEATER, SPACE, MULTI-FUEL, WITH BLOWER,
60,000 BTU/HR (HUNTER MODEL UH-68D)
FSN 4520-114-1055**

TM 5-4520-233-14, 6 June 1969, is changed as follows:
Page 2-1. Paragraph 2-1.1 is added after paragraph 2-1.

2-1.1. Maintenance and Operating Supplies

Maintenance and operating supplies required for the initial 8 hours operation of the heater are shown in table 2-1.

Table 2-1. Maintenance and Operating Supplies

(1) Component Application	(2) Federal Stock Number	(3) Description	(4) Qty Required For Initial Operation	(5) Qty Required For 8 Hours Operation	(6) Notes
	9130-160-1818	GASOLINE, AUTO, COMBAT MIL- G-3056, SPEC VV-G-76	6 gal	6 gal	Bulk
	9140-286-5924	FUEL OIL, REGULAR (DF-2)	6 gal	6 gal	Bulk
	9140-286-5286	FUEL OIL, WINTER (DF-1)	6 gal	6 gal	Bulk
	9140-286-5283	FUEL OIL, ARCTIC (DF-A)	6 gal	6 gal	Bulk

Page B-1. Appendix B is superseded as follows:

**APPENDIX B
BASIC ISSUE ITEM LIST AND ITEMS
TROOP INSTALLED OR AUTHORIZED**

Section I. INTRODUCTION

B-1. Scope

This appendix lists basic issue items, items troop installed or authorized which accompany the heater and are required by the crew/operator for operation, installation, or operator's maintenance.

B-2. General

This basic issue items, items troop installed or authorized list is divided into the following sections:

- Basic Issue Items List—Section II.* Not applicable.
- Items Troop Installed or Authorized List—Section*

III. A list in alphabetical sequence of items which at the discretion of the unit commander may accompany the end item, but are NOT subject to be turned in with the end item.

B-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items List, Section II, and Items Troop Installed or Authorized, Section III.

a. *Source, Maintenance, and Recoverability Code (s) (SMR):* Not applicable.

b. *Federal Stock Number.* This column indicates the Federal stock number assigned to the item and will

be used for requisitioning purposes.

c. *Description.* This column indicates the Federal item name and any additional description of the item required.

d. *Unit of Measure (U/M).* A 2-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based e.g., ft, ea, pr, etc.

e. *Quantity Authorized (Items Troop Installed or Authorized Only).* This column indicates the quantity of the item authorized to be used with the equipment.

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR Code	(2) Federal stock number	(3) Ref No. & Mfr code	Description	Usable on code	(4) Unit of meas	(5) Qty auth
	7520-559-9618		CASE, MAINTENANCE AND OPERATION MANUALS		EA	1

By Order of the Secretary of the Army:

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Distribution:
To be distributed in accordance with DA Form 12-25C, (qty rqr block no. 590) Organizational maintenance requirements for Heaters, Space 60,000 BTU.

CHANGE }
No. 3 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 19 December 1974

Operator's Organizational, Direct and
General Support Maintenance Manual

HEATER, SPACE, MULTI-FUEL, WITH BLOWER,
60,000 BTU/HR (HUNTER MODELS UH-68D AND UH-68E)

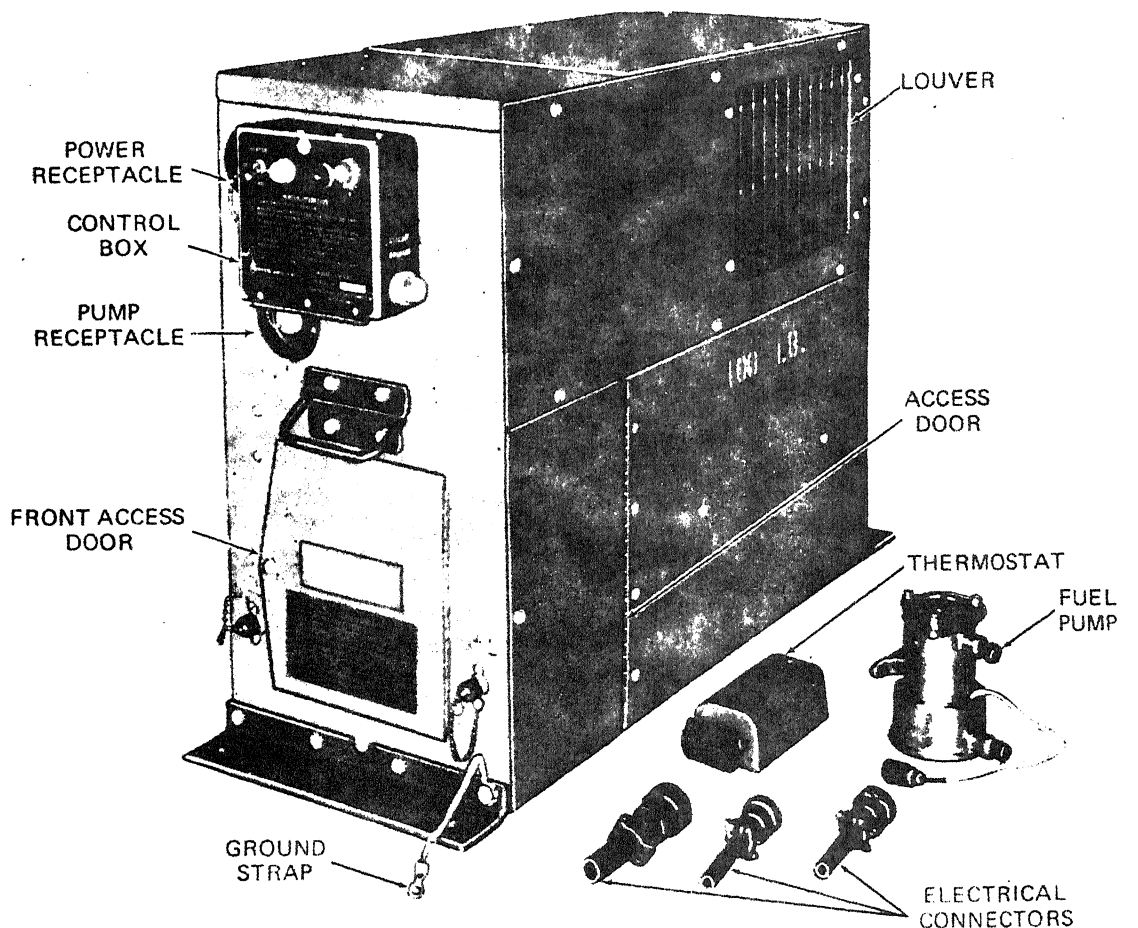
FSN 4520-114-1055 AND 4520-280-1830

TM 5-4520-233-14, 6 June 1969, is changed as follows:

The title is changed to read as shown above. Pages 1-1, 3-1, 4-1, and 5-1. In paragraphs 1-1a, 1-3a, 3-1a, 4-1, 5-1, 5-3, 5-5, 5-7, and 5-8, wherever the term "Model UH-68D" appears, change it to read "Models UH-68D and UH-68E."

Page 1-2, figure 1-1. After the illustration the following is added:

Figure 1-1.1. Space heater model UH-68E, right front view.



ME 4520-233-14/1-1.1 C3

Figure 1-1.1. Space heater Model UH-68E, right front view.

Page 1-3, figure 1-2. From the figure caption the term "model UH-68D" is deleted.

Paragraph 1-4a(1). After the fourth item the following is added:

Model UH-68E
Contract number DSA 700-73-C-8972
Serial number (range) . . 12350 thru 12561

Page 1-4, paragraph 1-4a(1). The second item is changed as follows:

Federal stock number

Model UH-68D 4520-114-1055

Model UH-68E 4520-280-1830

Paragraph 1-4a(2). After the fourth item the following is added:

Model UH-68E
Serial number 12350 thru 12561

Paragraph 1-4b(1). After the fourth item the following is added:

Model UH-68E
Serial number range . . 12350 thru 12561

Paragraph 1-4b(10). The third item is changed as follows:

Model (Model UH-68D) . . 2-68319-04

Model (Model UH-68E) . . 2-168538

Paragraph 1-4b(11). The third item is changed as follows:

Part No. (Model UH-68D) . 2-68255

Part No. (Model UH-68E) . 2-168526

Page 1-5, paragraph 1-4b(22). After the paragraph title is added "(Model UH-68D only)".

Paragraph 1-4b(23). After the paragraph title is added "(Model UH-68D only)".

The following is added after subparagraph 1-4b(23):

(23.1) Circuit breaker (Model UH-68E only).

Manufacturer Mechanical
Products, Inc.

Catalog No. 700-001-20

Rating 20 amp

Military Standard MS25244-20

Paragraph 1-5 is replaced with the following:

1-5. Differences in Models

This manual covers space heater supplied by Hunter Manufacturing Company as Model UH-68D, with serial numbers 10,002 through 11,381,

and Model UH-68E with serial numbers 12350 through 12561. Following are the pertinent areas of difference between these models:

a. Electrical Circuit Protection. Model UH-68D heaters are equipped with fuses in the main power circuit and in the fuel pump secondary circuit. Model UH-68E uses a circuit breaker with push-button reset in the main power circuit. No additional protection is used in the fuel pump secondary circuit.

b. Fuel Pump Mounting. Model UH-68D heaters have the fuel pump installed in the interior of the heater case, pre-wired into the heater circuits. With Model UH-68E heaters, the fuel pump is shipped uninstalled and requires external mounting between the fuel source and the FUEL RECEPTACLE connector as part of the installation procedure. External electrical leads are used to interconnect the fuel pump to the EXTERNAL FUEL PUMP RECEPTACLE on the heater case.

c. Fuel Port Seal Caps. Model UH-68D heaters do not have fuel port seal caps and chains installed to cover the FUEL RECEPTACLE and FUEL OVERFLOW connectors when they are not in use. Model UH-68E does incorporate this feature.

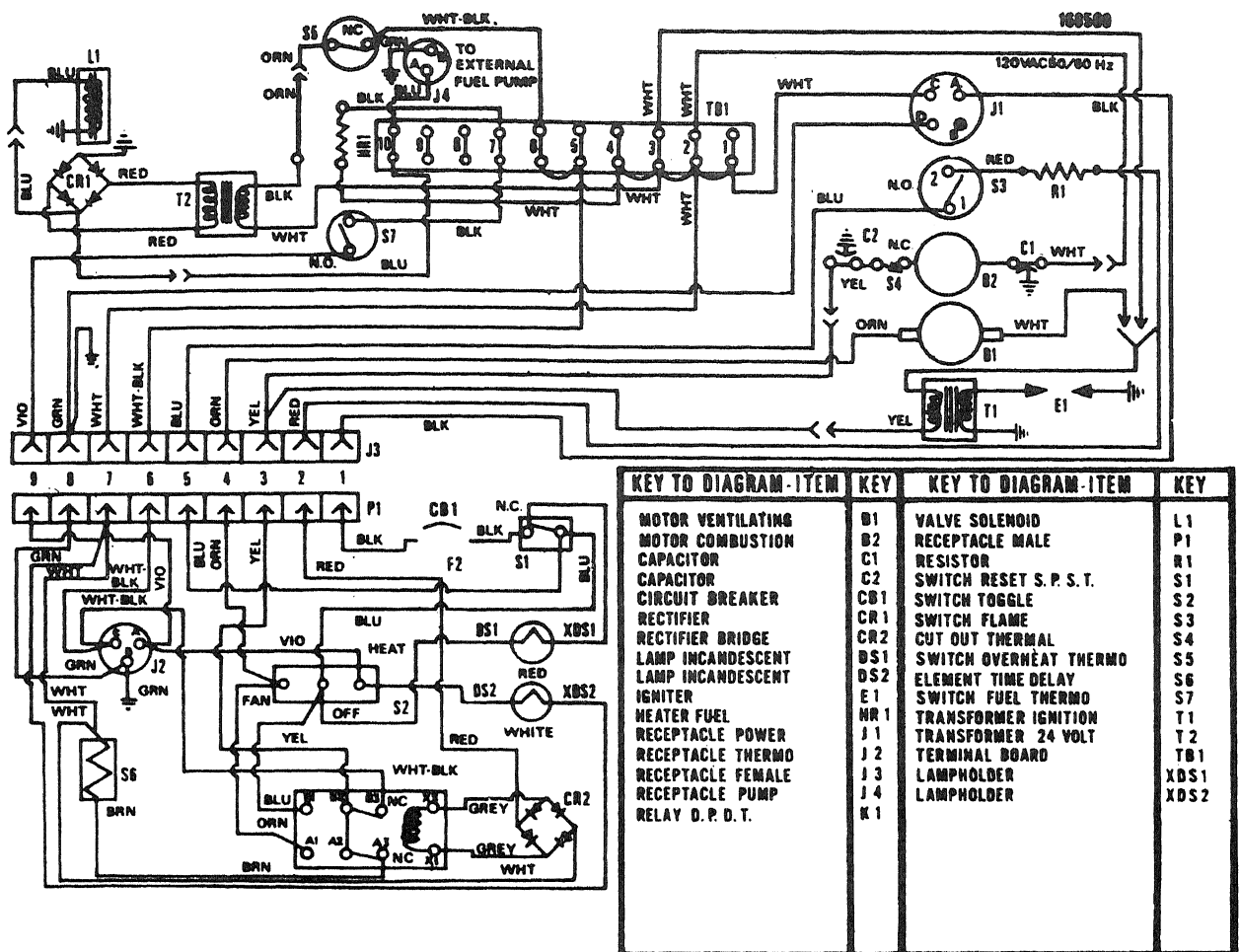
d. Ignition Transformer and Cable. Model UH-68D uses an ignition transformer in which the cable is an inseparable part, leading directly into the transformer case. Model UH-68E uses an ignition transformer that has a threaded connector to facilitate interconnection of the separate transformer to igniter cable.

e. Any other differences between the models are inconsequential and make no important differences during operation and maintenance.

Page 1-6. To the caption for figure 1-3 is added "(Model UH-68D)".

After figure 1-3 is added the following:

Figure 1-4. Wiring diagram (Model UH-68E).



ME 5420-233-14/1-4 C3

Figure 1-4. Wiring Diagram (Model UH-68E).

Page 2-2, paragraph 2-3b(5). First line is changed to read:

(5) On Model UH-68D, connect the fuel supply line to the

After paragraph 2-3b(5), the following is added:

(5.1) On Model UH-68E, the fuel pump is shipped uninstalled and must be remotely mounted between the fuel supply and the fitting marked FUEL RECEPTACLE. Mount the fuel pump as close to the fuel source as is practical. The pump is provided with two mounting holes that will accommodate 1/4-inch screws. Interconnect the fuel pump fuel outlet and the fitting marked FUEL RECEPTACLE with a fuel line. Make electrical connections using a two-wire, 16-gage, type MIL-W-5086 cable long enough to extend from the space heater to the fuel pump. Connect the end of the cable to the two-pin male plug that mates with the EXTERNAL FUEL PUMP RECEPTACLE electrical connector. Use an MS27144-1 connector to connect the cable to the fuel pump.

Page 3-1, paragraph 3-2, line 3. Delete the parenthetical phrase.

Page 3-3, table 3-2, Malfunction 1. The second Probable cause and Corrective action are changed as follows:

Probable cause	Corrective action
Fuse blown (Model UH-68D) or circuit breaker tripped (Model UH-68E)	Replace blown fuse or reset circuit breaker (para 3-25).

Malfunction 2. The third Probable cause and Corrective action are changed as follows:

Probable cause	Corrective action
Fuse blown (Model UH-68D) or circuit breaker tripped (Model UH-68E)	Replace blown fuse or reset circuit breaker (para 3-25).

Page 3-6, paragraph 3-12a. The figure reference in the first line is changed to read "(fig. 3-2 or 3-2.1)".

Paragraph 3-12b. The first two sentences are replaced with the following:

b. On Model UH-68E, the externally mounted fuel pump supplies fuel under pressure to the fuel inlet receptacle and through the fuel strainer. On Model UH-68D, fuel is drawn through the fuel filter and inlet line into the

internally mounted fuel pump. Both the externally mounted and internally mounted fuel pumps are plunger types which contain removable strainer screens. Fuel is then directed to the float bowl and solenoid valve.

Page 3-7, figure 3-2. To the caption is added "(Model UH-68D)".

After figure 3-2 is added the following:

Figure 3-2.1. Fuel system, schematic diagram (Model UH-68E).

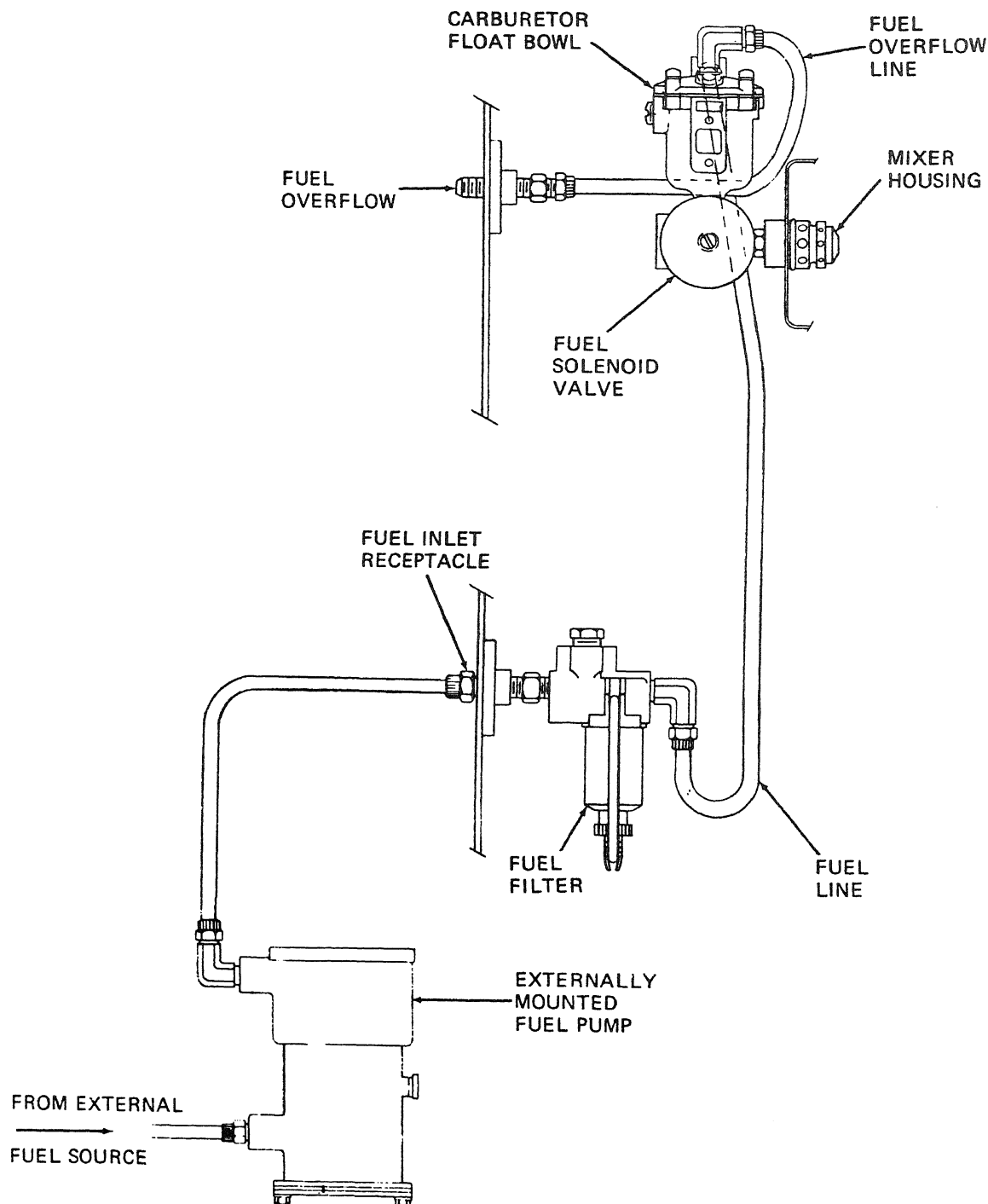


Figure 3-2.1. Fuel system, schematic diagram (Model UH-68E).

ME 4520-233-14/3-2.1 C3

Paragraph 3-14. The following is added under the paragraph title:

Note: The fuel pump of Model UH-68E is supplied loose and is mounted remotely during installation, with mounting varied to meet the needs of the particular installation. The fuel pump of the Model UH-68D is mounted within the case of the heater. Removal and installation instructions in this paragraph cover the internally installed fuel pump. The fuel pumps are identical, so service instructions are applicable to both heater models.

Paragraph 3-14c(1). The subparagraph is superseded as follows:

(1) Install the fuel pump as illustrated in figure 3-5.

Page 3-10, figure 3-5. To the figure caption is added "(Model UH-68D)".

Page 3-11, figure 3-6. The callout "FROM FUEL PUMP" is changed to read, "FROM FUEL PUMP (MODEL UH-68D) OR FROM FUEL STRAINER (MODEL UH-68E)"

Page 3-13, paragraph 3-17b. The second last sentence is superseded as follows:

On Model UH-68D, a 20-ampere fuse protects the circuit from overload; on Model UH-68E, the circuit is protected by a 20-ampere circuit breaker.

Paragraph 3-17c. The last two sentences are superseded as follows:

On Model UH-68D only, a separate 1/2-ampere fuse protects the 24-volt circuit. This circuit is energized whenever the reset switch is closed, the room thermostat is calling for heat, and the overheat thermostat is closed.

Page 3-14, paragraph 3-17d(1). The first sentence is superseded as follows:

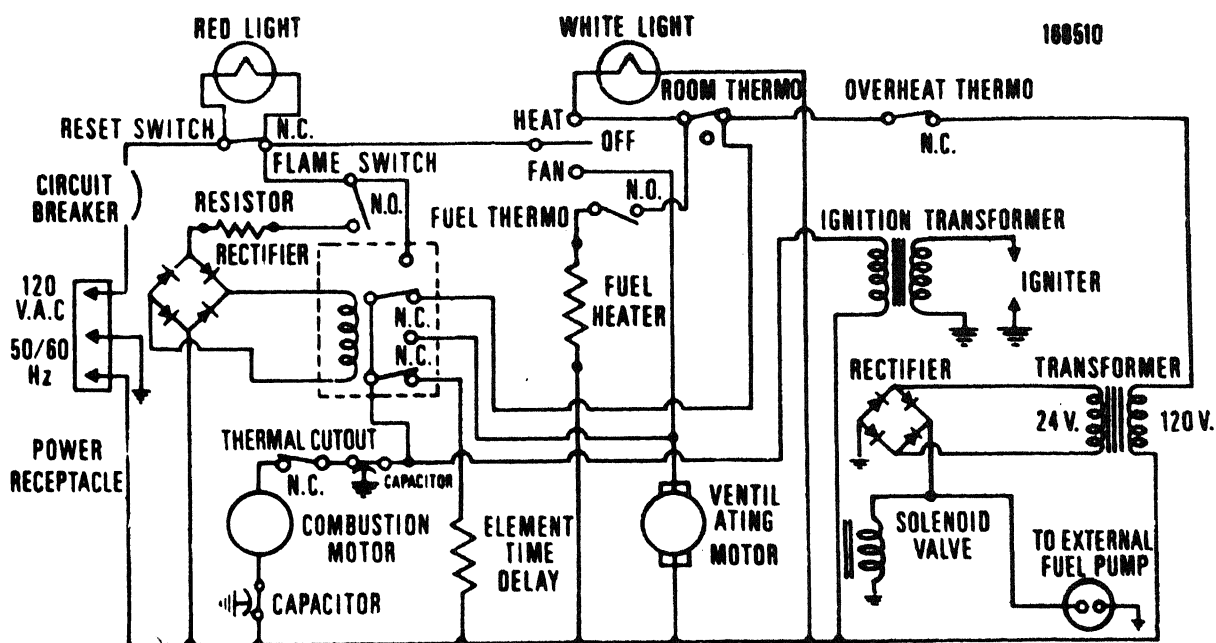
(1) With power applied to the POWER receptacle, the control switch in the HEATER position, and the room thermostat calling for heat, the AC circuit is traced from the pin of the POWER receptacle, through the 20-ampere fuse (Model UH-68D) or 20-ampere circuit breaker (Model UH-68E), through the normally closed reset switch, through the control switch in the HEATER position, to the white indicator lamp.

Paragraph 3-19a(2). The first sentence is superseded as follows:

(2) Remove the ignition transformer as illustrated in figure 3-10 or 3-10.1.

Page 3-15, figure 3-9. To the figure caption is added "(Model UH-68D)".

After figure 3-9 is added the following
Figure 3-9.1. Electrical schematic diagram (Model UH-68E)



ME 4520-233-14/3-9.1 C3

Figure 3-9.1. Electrical schematic diagram (Model UH-68E).

Paragraph 3-19c(1). The first sentence is superseded as follows:

(1) Install the ignition transformer as illustrated in figure 3-10 or 3-10.1.

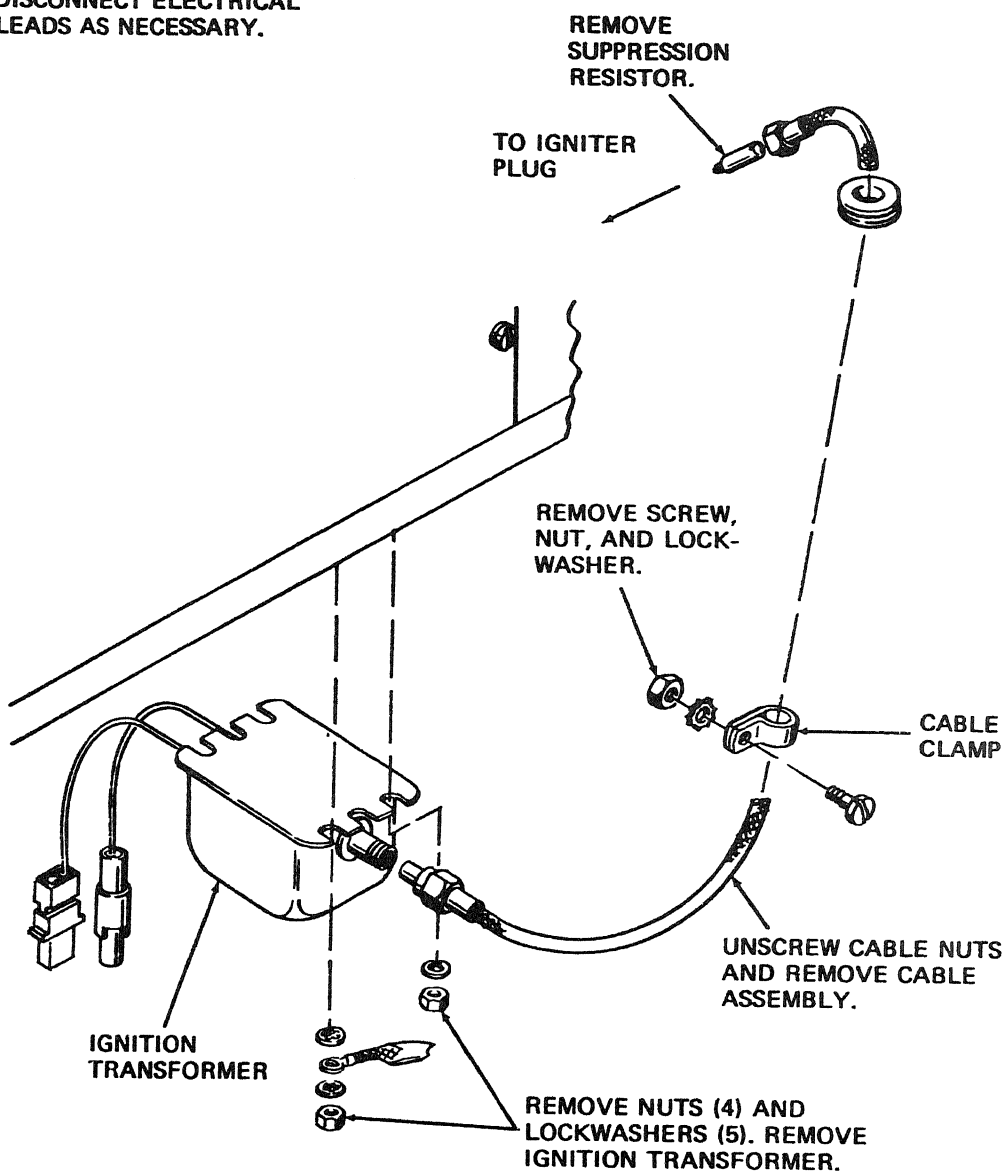
Page 3-16, figure 3-10. To the figure caption

is added "(Model UH-68D)".

After figure 3-10 is added the following:

Figure 3-10.1. Ignition transformer and suppression resistor, removal and installation (Model UH-68E).

NOTE: DISCONNECT ELECTRICAL LEADS AS NECESSARY.



ME 4520-233-14/3-10.1 C3

Figure 3-10.1. Ignition transformer and suppression resistor, removal and installation (Model UH-68E).

Page 3-17, paragraph 3-21a. To the paragraph title is added, "(UH-68D only)".

Paragraph 3-21b(3). The subparagraph is superseded as follows:

(3) Disassemble the fuel pump power supply as illustrated in figure 3-14 or 3-14.1.

Paragraph 3-21c(4). The subparagraph is superseded as follows:

(4) On Model UH-68D only, inspect the fuse for good condition; replace if defective.

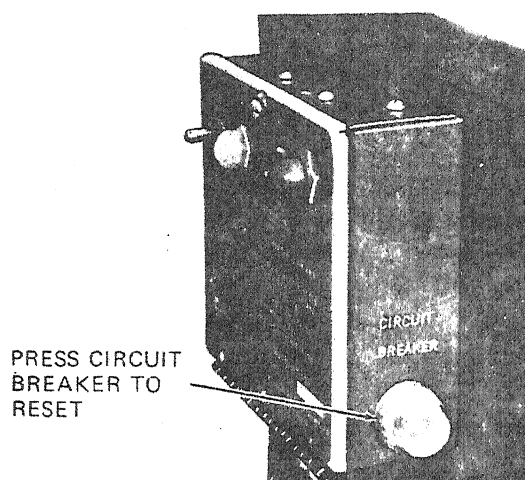
Paragraph 3-21c(1). The subparagraph is superseded as follows:

(1) Reassemble the fuel pump power supply as illustrated in figure 3-14 or 3-14.1.

Figure 3-12. To the figure caption is added "(Model UH-68D)".

After figure 3-12 is added the following:

Figure 3-12.1. Circuit breaker (Model UH-68E).



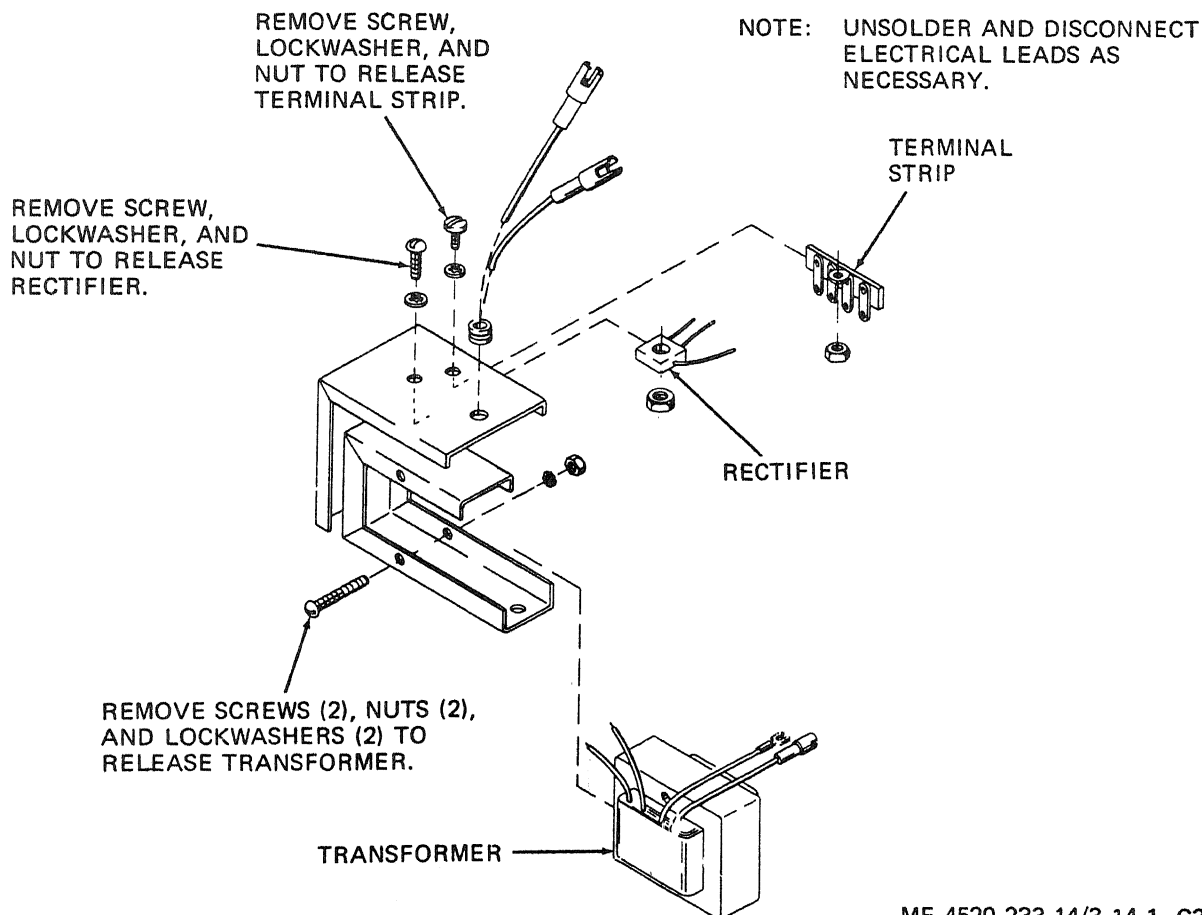
ME 4520-233-14/3-12.1 C3

Figure 3-12.1. Circuit breaker (Model UH-68E).

Page 3-18, figure 3-14. To the figure caption is added "(Model UH-68D only)".

After figure 3-14 is added the following:

Figure 3-14.1. Fuel pump power supply, disassembly and reassembly (Model UH-68E).



ME 4520-233-14/3-14.1 C3

Figure 3-14.1. Fuel pump power supply, disassembly and reassembly (Model UH-68E).

Page 3-19, paragraph 3-25b. To the subparagraph title is added "(Model UH-68D only)".

The following is added after paragraph 3-25b:

b.1. Control Box Circuit Breaker Reset (Model UH-68E only). Reset a tripped circuit breaker as instructed in figure 3-12.1.

Paragraph 3-25c(2). The subparagraph is superseded as follows:

(2) Disassemble the control box as illustrated in figure 3-19 or 3-19.1.

Page 3-20, paragraphs 3-25d(8) and (9). The subparagraphs are superseded as follows:

(8) On Model UH-68D, inspect the fuse for good condition. Replace if defective. Inspect the fuseholder and cap for cracks, broken or damaged socket or bayonet, damaged, bent, or broken terminal. Replace if damaged.

(9) On Model UH-68E, inspect the circuit breaker for cracks, loose or damaged ter-

minals, signs of overheating, and jammed or inoperative reset button. Inspect the flexible seal for loss of resilience and cracks. Inspect the adapter for distortion and damaged threads. Replace defective parts.

Page 3-21, paragraph 3-25e(1). The subparagraph is superseded as follows:

(1) Reassemble the control box as illustrated in figure 3-19 or 3-19.1. Refer to figure 1-3 or 1-4 for information regarding the connection of wires.

Page 3-22, figure 3-19. To the figure caption is added "(Model UH-68D)".

After figure 3-19 is added the following:

Figure 3-19.1. Control box, disassembly and reassembly (Model UH-68E).

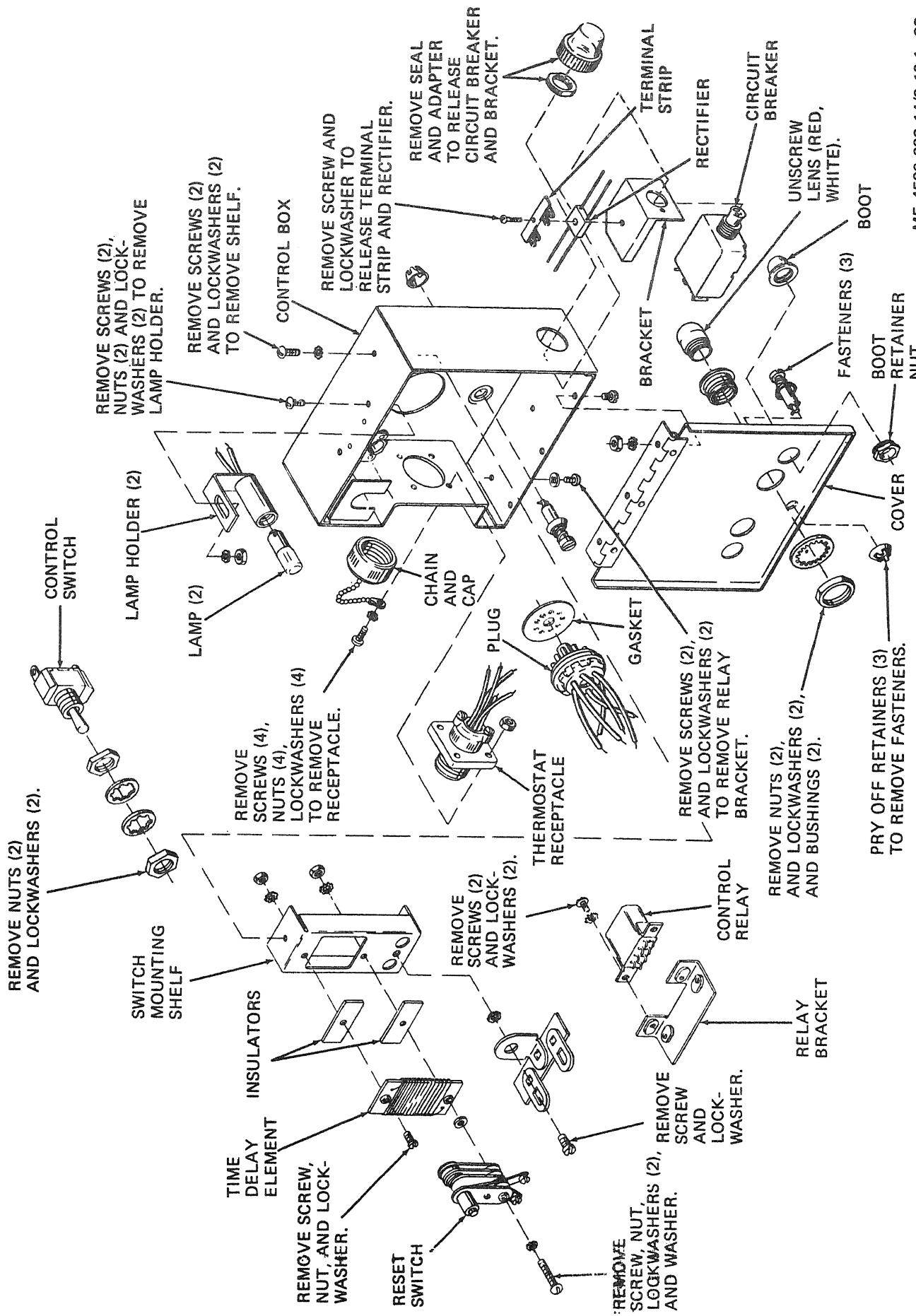


Figure 3-19.1. Control box, disassembly and reassembly (Model UH-68E).

Page 6-7. Figure 6-5 is changed as follows:

Asterisks (*) are added at station 16 on the vertical lead at lower left of the illustration and at station 16 in each of the charts.

The following footnote is added to the illustration:

*Not used on Model UH-68E.

By Order of the Secretary of the Army:

Official:

VERNE L. BOWERS

Major General, United States Army

The Adjutant General

FRED C. WEYAND
*General, United States
Chief of Staff*

Distribution:

To be distributed in accordance with DA Form 12-25C, (qty rqr block No.
Organizational maintenance requirements for Heaters, Space, 60,000 BTU.

TECHNICAL MANUAL

No. 4520-233-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 6 June 1969

**OPERATOR, ORGANIZATIONAL, DIRECT AND GENERAL
SUPPORT MAINTENANCE MANUAL
HEATER, SPACE, MULTI-FUEL, WITH BLOWER, 60,000 BTU/HR
(HUNTER MODEL UH-68D)
FSN 4520-114-1055**

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

a. These instructions are published for use by personnel to whom the Hunter Model UH-68D, Multi-fuel, Space Heater, with blower, is issued. Chapters 1 through 3 provide information on the installation, operation and operator's and organizational maintenance of the equipment. Chapter 4 provides instructions for shipment, limited storage, and demolition to prevent enemy use. Chapters 5 and 6 provide information for direct support and general support maintenance.

b. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

1-2. Forms and Records

a. DA Forms and records used for equipment maintenance will be only those prescribed in TM 38-750.

b. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to the Commanding General, U. S. Army Mobility Equipment Command, ATTN: AMS-ME-MPP, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120.

Section II. DESCRIPTION AND DATA

1-3. Description

a. General. The Hunter Model UH-68D Space Heater (fig. 1-1 and 1-2) is a completely self-contained, thermostatically-controlled unit rated at 60,000 BTU/hr. It will operate with gasoline conforming to specification MIL-G-3056 or VV-G-76, with any other gasoline (leaded or aromatic) up to 100 octane grade, and with diesel fuel conforming to specification VV-F-800, class DF-1, DF-2, or DF-A having a cloud point not higher than -55°F. The heater assembly consists of a cabinet, fuel system, ignition system, combustion air system, the heat exchanger with burner head, circulating air system, control panel, and an electrical control circuit.

Warning: Do not use fuel with rating exceeding 100 octane.

b. Mounting. The heater shall operate when rotated in 90° increments about an axis parallel to the long dimension of its base. The heater is supplied with the air discharge in the down position: when in such a position, the heater is

termed "inverted". Refer to paragraph 2-4 for instructions on converting the heater to the other possible positions.

c. Fuel System. Fuel is pumped from an outside source by the electric fuel pump. The fuel flows from the fuel pump to the carburetor float bowl. The carburetor meters and introduces the fuel into the air flow in the burner housing. At low ambient temperatures, heating element in the carburetor assembly preheats the fuel for easier ignition.

d. Ignition System. The spark for combustion is supplied by an igniter in the combustion chamber. The ignition transformer changes the 120-volt, ac input voltage to the 5000 volts used to create a spark at the igniter. The igniter is constantly sparking during operation so ignition is continuous.

e. Combustion Air System. Combustion air is drawn in by the motor and blower assembly. The air is ducted from the blower to the burner head.

f. Circulating Air System. Circulating air is taken into the heater through louvers in the right

and left side panels. The circulating air motor drives the axial fan which forces the air around the heat exchanger of the combustion chamber and out of the discharge opening. Louvers are controlled by pushing the control rod all the way to open the right-hand louver and close the left-hand louver; pulling the control rod reverses the louvers.

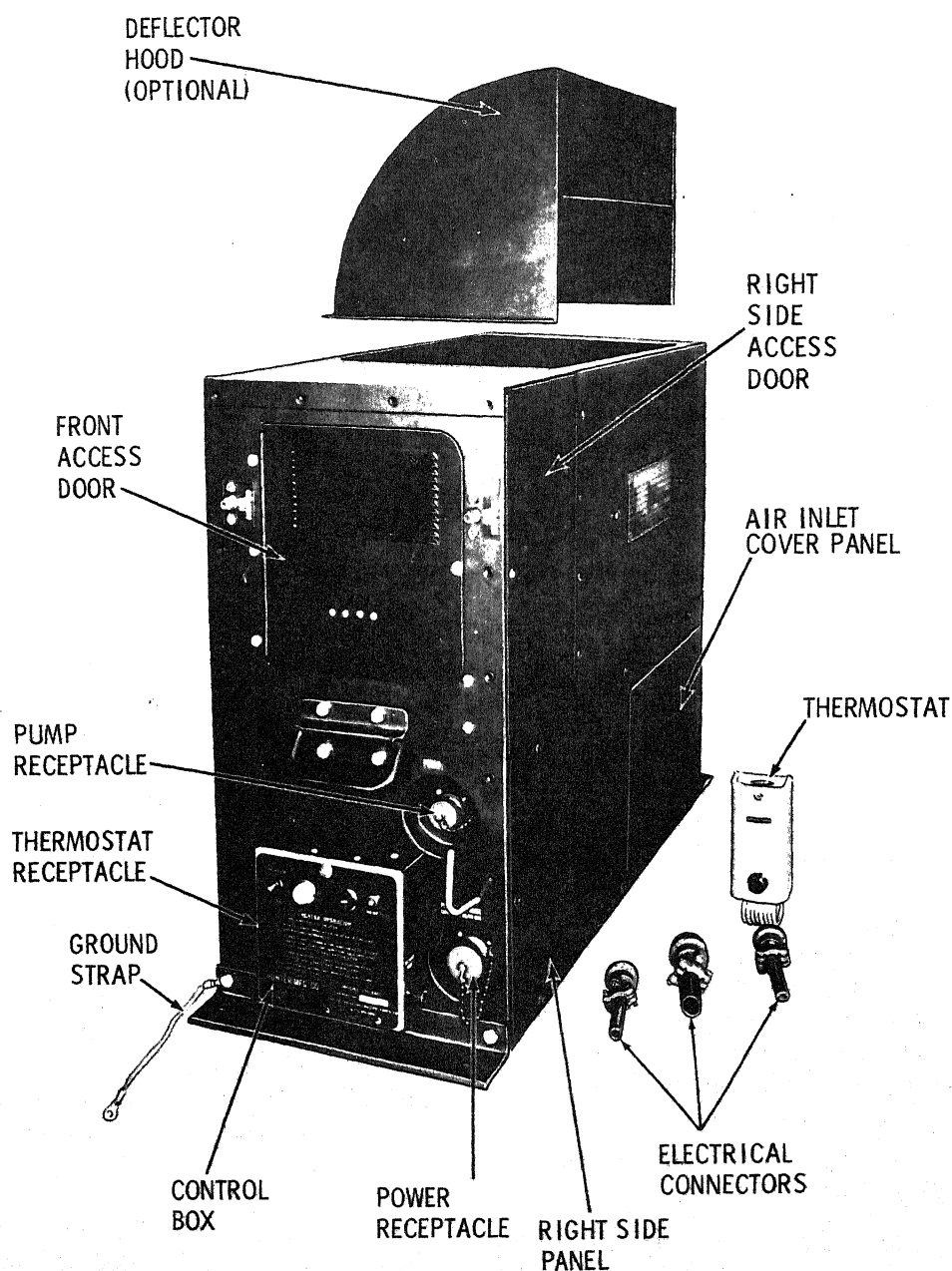
g. Control Panel. The heater control panel is located on the control box at the front of the heater. It contains all the switches and indi-

cators, except the room thermostat, necessary to operate the heater.

h. Electrical Control Circuit. The electrical control circuit consists of all the electrical components necessary to operate and cycle the heater. The circuit is explained in paragraph 3-17.

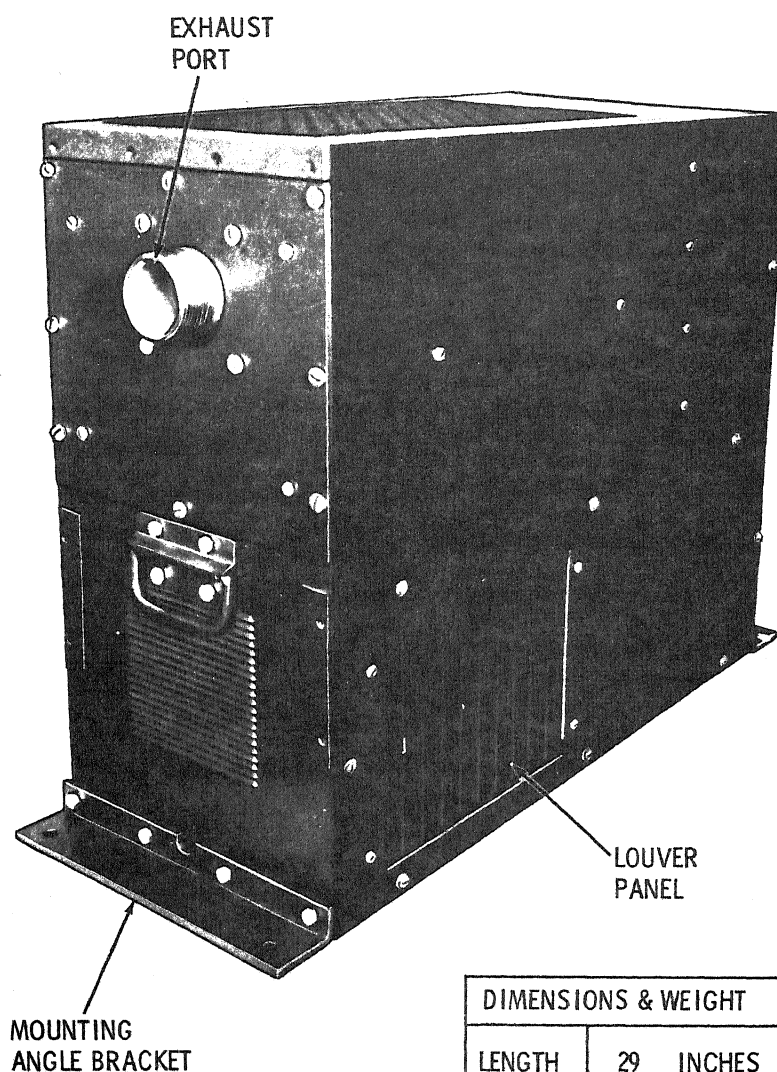
1-4. Identification and Tabulated Data

a. Identification. The space heater has four major identification and instructions plates. The military identification plate is secured to the right



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Figure 1-1. Space heater model UH-68D, right front, view.



DIMENSIONS & WEIGHT		
LENGTH	29	INCHES
WIDTH	11	INCHES
HEIGHT	21.2	INCHES
WEIGHT	130	POUNDS

MEC 4520-233-14/1-2

Figure 1-2. Space heater model UH-68D, left rear view.

side panel of the unit. The manufacturer's plate is mounted on the front of the control panel. It contains brief operating instructions along with the information indicated below. Two additional instruction plates are provided on the inside of the right-hand access door. These contain the electrical schematic diagram and a practical wiring diagram. The military identification plate and the manufacturer's plate contain the following data:

(1) *Military identification plate.*

Nomenclature ----- Heater, space, 60,000 BT
 Model ----- UH-68D
 Contract number ----- 700-68B572
 Serial number (range) ----- 10,002 through 10,501
 Capacity ----- 60,000 BTU
 Register number ----- --
 Gross weight ----- 120 lb.
 Length ----- 29 in.
 Height ----- 21.2 in.
 Width ----- 11 in.

Cubage -----
 Federal stock number -----4520-114-1055
 Warranty -----12 months
 Date shipped -----
 Date inspected -----
 Inspector's stamp -----
 Manufactured by -----Hunter Manufacturing Co.

(2) *Manufacturer's plate.*

Manufacturer's name -----Hunter Manufacturing Co.
 Manufacturer's address -----Cleveland (Solon) Ohio
 -----44139
 Model -----UH-68D
 Serial number -----10,002 thru 10,501
 Electrical requirements -----120 volts ac, 50/60 cps,
 -----7 amps
 Rating -----60,000 BTU

b. *Tabulated Data*

(1) *Space heater.*

Manufacturer -----Hunter Manufacturing Co.
 Model -----UH-68D
 Type -----Self-contained, multifuel,
 -----portable
 Serial number range -----10,002 thru 10,501

(2) *Room thermostat.*

Manufacturer -----Hunter Manufacturing Co.
 Type -----Differential—Non-Adjust-
 -----able
 Model -----68279
 Rating -----120 volt ac
 Range -----35°F to 95°F

(3) *Carburetor assembly.*

Manufacturer -----Hunter Manufacturing Co.
 Model -----1-68164-02
 Fuel heater -----75 watts, 120 volt ac
 Fuel float valve -----Tillotson Manufacturing Co.
 -----Catalog No. 013440

(4) *Fuel filter.*

Manufacturer -----Zenith Carburetor Div.,
 -----Bendix Corp.
 Military Standard -----MS 51086-1
 Type -----Strainer element

(5) *Fuel pump.*

Manufacturer -----Conelec, Inc.
 Model -----106091
 Type -----Electric
 Rating -----24 volt dc
 Ground -----Negative

(6) *Combustion motor and blower assembly.*

Manufacturer -----Lamb Electric Co.
 Type -----AC motor with integral fan
 Part No. -----IS14965
 Horsepower -----3/8
 Rev. per Min -----115
 Volts -----60
 Rotation -----CCW facing fan end

(7) *Circulating air motor.*

Manufacturer -----Hunter Manufacturing Co.
 Type -----AC, totally enclosed, auto-
 -----matic overload reset
 Model -----68425
 Rating -----1/16 hp, 1425-1725 rpm, 115
 -----volt, 50-60 cycles, single
 -----phase
 Rotation -----CCW opposite shaft end

(8) *Circulating air fan.*

Manufacturer -----Torrington Manufacturing
 -----Co.
 Type -----Axial vane with hub
 Part No. -----A14783
 Rotation -----CW with hub on intake side

(9) *Igniter plug.*

Manufacturer -----Hunter Manufacturing Co.
 Type -----Preset gap
 Part No. -----2-68181 (incl. gasket 65183)

(10) *Ignition transformer.*

Manufacturer -----Hunter Manufacturing Co.
 Type -----Power step-up
 Model -----2-68319-04
 Primary -----120 volts ac
 Secondary -----5000 volts ac

(11) *Power transformer.*

Manufacturer -----Hunter Manufacturing Co.
 Type -----Power step-down
 Part No. -----2-68255
 Primary -----120 volts ac
 Secondary -----24 volts ac

(12) *Control relay.*

Manufacturer -----Price Electric Corp.
 Type -----DPDT
 Part No. -----B07A312AC3
 Rating -----26.5 vdc, 300 ohms

(13) *Flame switch relay.*

Manufacturer -----Hunter Manufacturing Co.
 Type -----SPDT
 Catalog No. -----2-68458

(14) *Heater-fan switch.*

Manufacturer -----Cutler-Hammer, Inc.
 Type -----3 position toggle, center OFF
 Catalog No. -----7502K13

(15) *Reset switch.*

Manufacturer -----Stevens Manufacturing Co.,
 -----Inc.
 Type -----Normally closed, non-adjust-
 -----able
 Model -----SM30
 Rating -----Open at 370° ±13°F

(16) *Control relay rectifier.*

Manufacturer -----Westinghouse Electric Corp.
 Part No. -----MP 010ABD

(17) *Fuel pump power supply rectifier.*

Manufacturer -----Westinghouse Electric Corp.
Type -----Silicon
Model -----MP 010ABD

(18) *Thermocouple.*

Manufacturer -----General Controls Co., Inc.
Type -----Bimetal
Catalog No. -----G250A13

(19) *Overheat thermostat.*

Manufacturer -----Thermo-Disc Inc.
Type -----36T21
Rating -----Open at 270° ± 7°F, close
at 245° ± 8°F

(20) *Fuel heater thermostat.*

Manufacturer -----Stevens Manufacturing Co.,
Inc.
Catalog No. -----110047
Rating -----Open at 45° ±5°F, close at
30° ±6°F

(21) *Solenoid valve coil.*

Manufacturer -----Hunter Manufacturing Co.
Type -----24 volt dc
Part No. -----1-68558

(22) *Main fuse.*

Manufacturer -----Littelfuse, Inc.
Type -----Ceramic
Catalog No. -----314020
Rating -----20 amp. 125 volt

(23) *Fuel pump fuse.*

Manufacturer -----Littelfuse, Inc.
Type -----Glass
Catalog No. -----312.500—3AG
Rating -----1/2 amp, 250 volt

(24) *Time delay element.*

Manufacturer ----- Hunter Manufacturing Co.
 Part No. ----- 48445
 Rating ----- 50 \pm 5% watts at 120 volt ac
 Normal operating conditions ----- Closed
 Operating time ----- 60 sec min

(25) *Overall dimensions and weight.*

Overall length _____ 29 in.
Overall width _____ 21.2 in.
Overall height _____ 11 in.
Net weight _____ 115 lb
Shipping volume _____
Shipping weight _____

(26) *Wiring diagram.* Refer to figure 1-3.

(27) *Maintenance and operating supplies.*

Refer to appendix B for a complete list of maintenance and operating supplies required for initial operation.

1–5. Differences in Models

This manual covers only space heater Model UH-68D, manufactured by Hunter Manufacturing Company and supplied under serial numbers 10,002 thru 10,501. There are no known differences among these models.

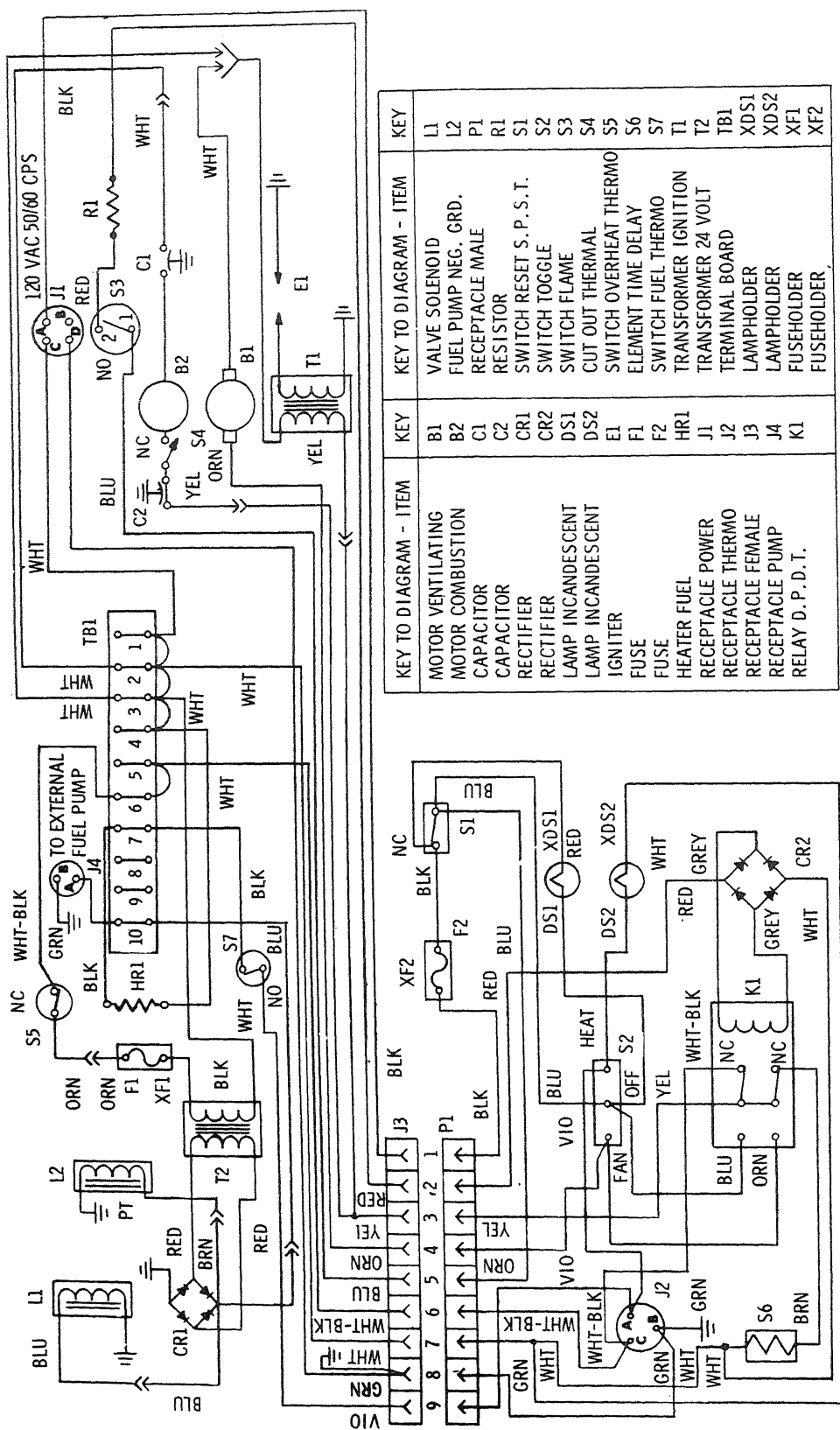


Figure 1-3. Wiring diagram.

CHAPTER 2

INSTALLATION AND OPERATION INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

2-1. Inspecting and Servicing the Equipment

a. Remove the space heater from its box. Carefully examine the exterior of the heater for signs of damage during shipment. Report any damage to the proper authority.

b. Open all access doors and remove all access panels.

c. Perform the daily preventive maintenance services described in table 3-1.

2-2. Installation of Separately Packed Components

The separately packed components supplied with the space heater are the thermostat and electrical connectors. Thermostat and electrical connector installation is covered in paragraph 2-3.

2-3. Installation or Setting Up Instructions

Note. If the heater is to be mounted in any position other than an upright, vertical position, refer also to paragraph 2-4.

a. Location.

(1) Position the heater so that the exhaust can be connected to the outside with a short, direct run and so that fresh air will be pulled in through the heater air inlet openings. The heater is equipped with louvers in both side panels for inlet air. If the heater can be located to heat the space better when mounted in a horizontal position or in an inverted position, modify the heater as described in paragraph 2-4.

(2) If the heater is to be used in the upright position, the hood (if supplied) (fig. 1-1) can be mounted on the air discharge to deflect the air flow. The hood can be mounted in either of two positions, 180 degrees apart, to direct the air flow toward either side.

(3) The space heater is equipped with two angle brackets for base mounting. The brackets are drilled to receive 5/16 inch bolts or lag

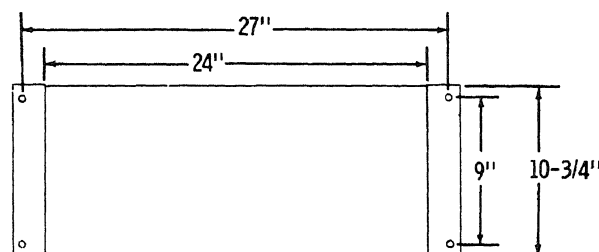
screws. Refer to figure 2-1 for base mounting dimensions.

b. Installation.

(1) Mount the room thermostat in an upright position on an inside or insulated wall in the area to be heated. Do not install the thermostat in line with the heater air inlet or discharge air flow or in a drafty position, or on outside wall.

(2) Remove the thermostat cover and attach a 3-wire, 16-gage cable, long enough to reach between heater and thermostat, to the thermostat, securing the cable ground wire to one of the thermostat mounting screws. Attach the other end of the cable to the male plug that is shipped separately. Make sure the ground wire of the cable is connected to the ground lug (pin B) of that plug. Connect the plug to the room thermostat receptacle at the side of the heater control box (fig. 1-1).

(3) Provide a 3-wire, 16-gage cable, long enough to reach between the power source and heater. Connect one end of the cable to the female plug that is shipped separately, making sure the ground wire is connected to the ground lug (pin D) of the plug. Connect the other end of the cable to the power source. Make sure the ground lead is connected to power source ground. With the control switch OFF, insert the



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Figure 2-1. Base mounting dimensions.

female plug into the POWER RECEPTACLE (fig. 1-1) of the heater.

(4) Connect an exhaust line from the exhaust connection of the heater to the outside. Make sure there are no restricted sharp bends or turns and that the pipe inside diameter is the same as that of the exhaust connection. Seal the exhaust pipe joints.

Warning: Do not operate the heater in an enclosed area unless the exhaust gases are piped to the outside. Inhalation of exhaust fumes will result in serious illness or death.

(5) Connect the fuel supply line to the fitting marked FUEL RECEPTACLE. If an auxiliary fuel pump is used to supply fuel from the fuel source to the space heater, connect the fuel pump to the PUMP electrical connector on the front panel. Use a two-wire, 16-gage cable, type MIL-W-5086, long enough to extend from the fuel pump to the space heater. Connect the end of the cable to the two-pin male plug that mates with the PUMP electrical connector.

(6) Connect an overflow drain line from the FUEL OVERFLOW connection on the space heater. Insert the end of the drain line into a suitable container to catch the fuel in the event of an overflow.

2-4. Equipment Conversion

The space heater can be converted to operate in any of three positions other than the upright vertical position. Proceed as follows:

a. Heater Modification for Horizontal Mounting (Resting on Right Side).

(1) Disconnect the fuel line from the carburetor. Remove the four screws that secure the carburetor assembly to the burner housing. Rotate the carburetor 90 degrees so that the float bowl of the carburetor will be up, above the fuel adjustment screw when the space heater is in the horizontal position (C, fig. 2-2). Install the four screws to secure the carburetor to the burner housing. Reconnect the fuel lines to the carburetor.

(2) Remove the screws that secure the FUEL RECEPTACLE bulkhead connector and the FUEL OVERFLOW bulkhead connector to the front panel. Interchange the positions of the two connectors and their tags. When interchanging the FUEL RECEPTACLE connector, interchange the fuel filter assembly with it.

After the FUEL RECEPTACLE connector is mounted, rotate the fuel filter 90 degrees so that the fuel bowl will be down when the heater is in the horizontal position.

(3) Adjust the position of the louver control handle so that the louvers of the unobstructed opening are open.

(4) Remove the four capscrews and lockwashers that secure each of the mounting angle brackets to the heater and reposition the brackets along the side edges of the heater so that it can be secured to the floor.

(5) Open the control box cover and loosen the two twist-lock fasteners (fig. 3-3) that secure the control box to the space heater. Remove the control box and reposition on the heater so that the printing on the control panel is upright. Secure the panel with two fasteners. Close the control box cover.

b. Heater Modification for Horizontal Mounting (Heater Resting on Left Side).

(1) Disconnect the fuel lines from the carburetor. Remove the four screws that secure the carburetor assembly to the burner housing. Rotate the carburetor 90 degrees so that the float bowl of the carburetor will be up, directly above the fuel adjustment screw when the heater is in the horizontal position (B, fig. 2-2). Install the four screws that secure the carburetor to the burner housing. Reconnect the fuel lines to the carburetor.

(2) Rotate the fuel filter 90 degrees so that the fuel bowl will be down when the heater is in the horizontal position.

(3) Interchange the position of the igniter and the plug on the burner housing. The igniter must always be above the fuel inlet port at which the carburetor output enters the burner housing.

(4) Adjust the position of the louver control handle so that the louvers of the unobstructed opening are open.

(5) Remove the four capscrews and lockwashers that secure each of the mounting angle brackets to the heater and reposition the brackets along the side edges of the heater so that it can be secured to the floor.

(6) Open the control box cover and loosen the two twist-lock fasteners (fig. 3-3) that secure the control box to the space heater. Remove the control box and reposition on the heater so that the printing on the control panel is upright. Secure the panel with two fasteners. Close the control box cover.

c. Heater Modifications for Inverted Mounting.

(1) Disconnect the fuel lines from the carburetor. Remove the four screws that secure the carburetor assembly to the burner housing. Rotate the carburetor 180 degrees so that the float bowl of the carburetor will be up, directly above the fuel adjustment screw when the heater is in the inverted position (D, fig. 2-2). Install the four screws that secure the carburetor to the burner housing. Reconnect the fuel lines to the carburetor.

(2) Disconnect the fuel line from the elbow on the fuel filter. Remove the two screws that secure the FUEL RECEPTACLE bulkhead connector to the front panel of the space heater. Invert the bulkhead connector and fuel filter and secure with the two screws. Reposition the elbow on the fuel filter and connect the fuel line to the elbow.

(3) Interchange the positions of the igniter and plug on the burner housing. The igniter must always be above the fuel inlet port at which the carburetor output enters the burner housing.

(4) Remove the four capscrews and lockwashers that secure each of the mounting angle brackets to the heater and reposition the brackets along the top edges of the heater so that it can be secured on the floor.

(5) Open the control box cover and loosen the two twist-lock mounting screws (fig. 3-18) that secure the control box to the space heater. Remove the control box and reposition on the heater so that the printing on the control panel is upright. Secure the panel with two fasteners. Close the control box cover.

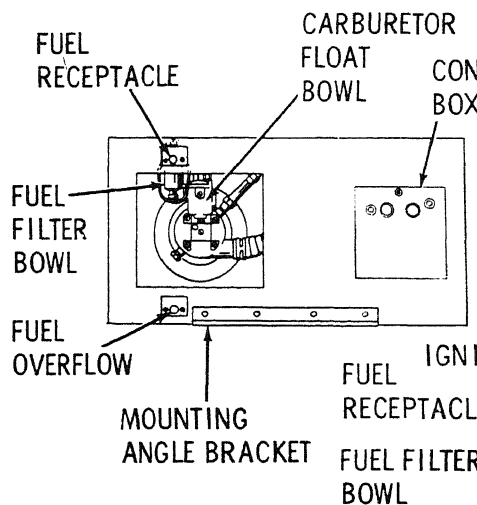
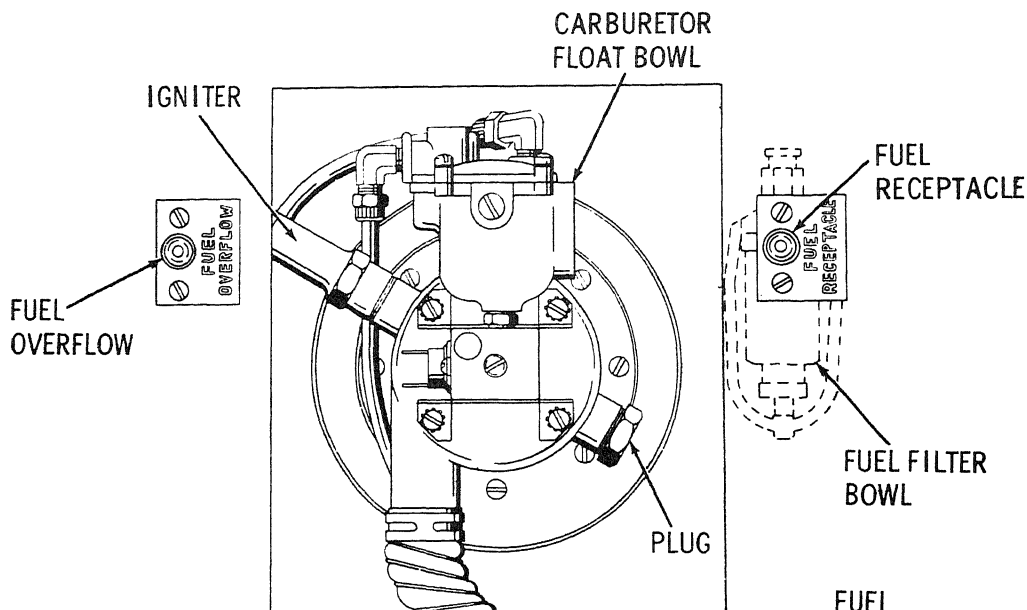
d. When to Use Side Covers

(1) Side covers (fig. 3-25) are provided to cover the return air openings on both sides of the heater, when the optional return air opening on the bottom of heater is used.

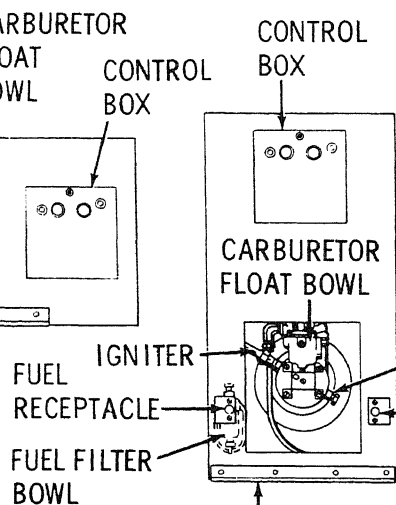
(2) To use the side covers, remove the four screws from each side of the heater return air panel and attach the cover with the screws thus removed. (fig. 3-25.)

(3) When side covers are used, remove the bottom plate from the optional air opening (fig. 3-24).

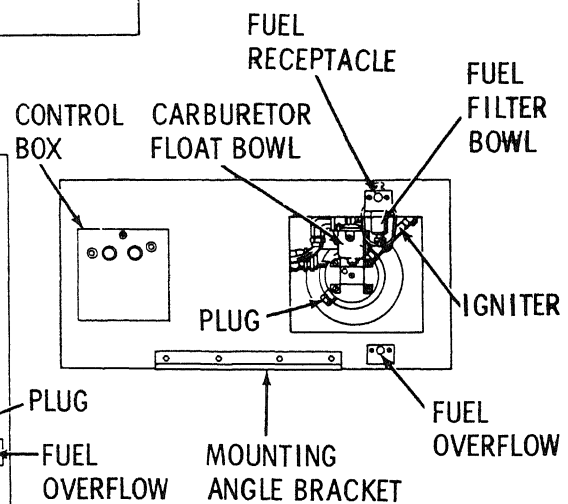
A HEATER MOUNTED IN UPRIGHT POSITION



B HEATER RESTING ON LEFT SIDE



D HEATER INVERTED



C HEATER RESTING ON RIGHT SIDE

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Figure 2-2. Modification required for various mounting positions.

Section II. MOVEMENT TO A NEW WORK SITE

2-5. Dismantling for Movement

a. Disconnect the electrical lead of the external fuel pump from the PUMP receptacle. Disconnect the fuel input line from the FUEL RECEPTACLE.

b. Operate the control switch to the HEATER position and adjust the thermostat to a high

enough temperature so that the heater will start. Allow the heater to run to purge all fuel from the unit.

c. Disconnect input power and remove the plug of the power input cable from the POWER RECEPTACLE. Unsolder the plug from the input power cable.

d. Remove the thermostat cable plug from the ROOM THERMOSTAT receptacle. Unsolder the plug from the thermostat cable.

e. Disconnect the thermostat cable from the thermostat. Remove the thermostat.

f. Remove the bolts or lug screws that secure the heater mounting angle brackets to the floor to free the heater.

2-6. Reinstallation after Movement

Install the space heater as directed in paragraph 2-3. If the space heater had been mounted in a position other than upright and vertical, it will be necessary to reposition some components before it can be operated in an upright, vertical position. Refer to figure 2-2 for the proper mounting position of components for the various mounting situations.

Section III. CONTROLS AND INSTRUMENTS

2-7. General

This section describes the various controls and indicators and provides the operator/crew sufficient information to insure proper operation of the space heater.

2-8. Controls and Indicators

The purpose of the controls and indicators is illustrated in figure 2-3.



Figure 2-3. Controls and indicators.

Section IV. OPERATION UNDER USUAL CONDITIONS

2-9. General

a. The instructions in this section are published for the information and guidance of personnel responsible for the operation of the space heater.

b. The operator must know how to perform every operation of which the space heater is capable. This section gives instructions on starting and stopping the space heater, operation of the space heater, and on coordinating the basic operation to perform the specific tasks for which the equipment was designed. Since nearly every job presents a different problem, the operator may have to vary the given procedure to fit the individual job.

2-10. Starting

a. Preparation for Starting.

(1) Perform the before-operation checks and services (para 3-4).

(2) If immediate heating is desired, it will be necessary to adjust the room thermostat so that the adjustment setting exceeds the ambient temperature of the room.

b. *Starting.* Refer to figure 2-4 and start the space heater.

2-11. Stopping

Refer to figure 2-5 and stop the space heater.

2-12. Operation of Equipment

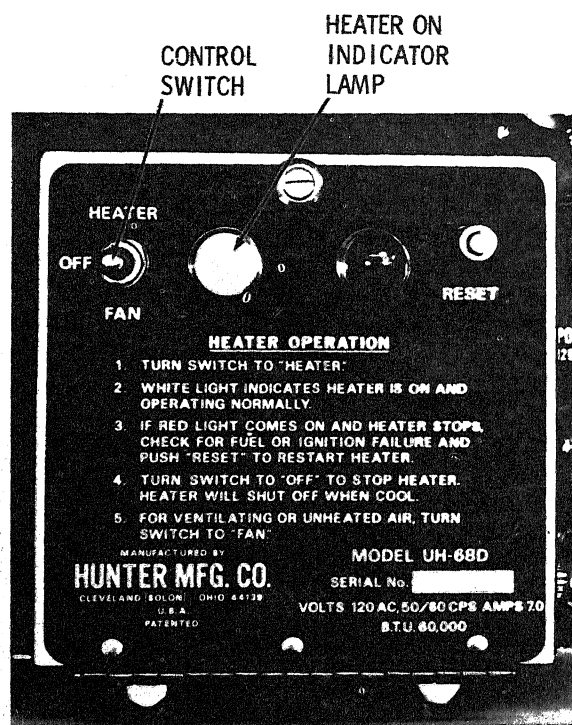
a. The space heater operates automatically under thermostatic control when the control switch is in the HEATER position, supplying heat when it is called for by the thermostat, and shutting off when the heat requirement is satisfied. When the white indicator lamp glows, it indicates that the heater is operating normally.

b. When the red indicator lamp lights, it indicates that the heater has stopped because of some malfunction such as loss of fuel, ignition failure, combustion air failure, and, or, circulating air failure. See section III on troubleshooting. Cor-

rect the cause of the stoppage and press the R5-SET pushbutton to restore heater operation.

c. When the control switch is in the FAN position, the fan runs continuously without thermostatic control.

d. If the type of fuel is changed, it may be necessary to readjust the FUEL ADJUSTMENT setting on the carburetor to obtain proper combustion (para 3-15d).



- STEP 1. OPERATE CONTROL SWITCH TO EITHER HEATER OR FAN POSITION, DEPENDING UPON WHETHER HEATED AIR OR ONLY CIRCULATION IS DESIRED.
- STEP 2. FOR HEATING, CHECK THE SETTING OF ROOM THERMOSTAT. RESET TO DESIRED TEMPERATURE IF NECESSARY.
- STEP 3. CHECK THAT WHITE HEATER ON INDICATOR LAMP GLOWS.

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Figure 2-4. Starting the space heater.



Figure 2-5. Stopping the space heater.

Section V. OPERATION UNDER UNUSUAL CONDITIONS

2-13. Operation in Extreme Cold

A fuel heater, located in the carburetor assembly, is energized through the operation of a thermostat when temperature drops below $30 \pm 5^\circ$ Fahrenheit. This heater automatically preheats the fuel to maintain a satisfactory viscosity of the fuel to aid in maintaining the input during extremely cool weather. However, the operator must take the following precautions to assure trouble free cold-weather operation:

- Keep the external fuel supply tank full to prevent condensation of moisture in the tank.
- Service the fuel filter (para 3-13a) daily to remove water that could freeze and clog the fuel system.
- Adjust the FUEL ADJUSTMENT setting on the carburetor to obtain the most efficient combustion (para 3-15d).

2-14. Operation in Dusty or Sandy Areas

- Protect the heater from blowing dust and sand.

- Service the fuel filter frequently to prevent the accumulation of dirt (para 3-13a).

2-15. Operation under Rainy or Humid Conditions

- Wipe moisture from all accessible exposed areas frequently.
- Service the fuel filter frequently to prevent an accumulation of water in the fuel filter bowl (para 3-13a).
- Paint all chipped or scratched surfaces to prevent rust.
- If it is in an exposed area, cover the heater when not in use.

2-16. Operation in Salt-Water Areas

- Salt water can cause corrosion of all metal parts of the space heater. Wipe the unit with a clean cloth dampened with fresh water and dry thoroughly.
- Repaint or touch up chipped and peeled paint as required to protect exposed metal surfaces.

2-17. Operation at High Altitudes

a. The heater is designed to operate at elevations up to 10,000 feet above seal level without special service or adjustment.

b. Because of the reduced oxygen supply at

10,000 feet elevation, heat output may be reduced approximately 15 percent. This is a normal condition which cannot be prevented, but optimum performance can be obtained by following all service instructions carefully.

CHAPTER 3

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. OPERATOR'S AND ORGANIZATIONAL MAINTENANCE REPAIR PARTS, TOOLS, AND EQUIPMENT

3-1. Tools and Equipment

a. Basic issue tools and repair parts issued with or authorized for Space Heater Model UH-68D are listed in the Basic Issue Items List, Appendix B of this manual.

b. No special tools or equipment are required

to perform operator's or organizational maintenance on the space heater.

3-2. Organizational Maintenance Repair Parts

Organizational maintenance repair parts are listed and illustrated in TM 5-4520-233-24P (When printed).

Section II. PREVENTIVE MAINTENANCE

Note. This equipment requires no lubrication. The bearings on the operating parts have been lubricated and sealed at manufacture and required no lubrication between overhaul periods.

3-3. General

To insure that the space heater is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are listed and described in paragraph 3-4. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future cor-

rection, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

3-4. Preventive Maintenance Checks and Services

Refer to Table 33-1 for a tabular listing of preventive maintenance checks and services for operator and organizational maintenance.

Table 33-1. Preventive Maintenance Checks and Services

Item number	Interval					B—Before operation		A—After operation		M—Monthly		
	Operator				Org.		D—During operation		W—Weekly		Q—Quarterly	
	Daily				M	Q	Item to be inspected	Procedure	Reference			
	B	D	A	W								
1	X									Fuel Supply	Check that fuel supply is adequate for operating period.	Para 3-28
2	X									External Fuel Connection	Check connections for leaking and damage, refer to organizational maintenance for correction.	
3	X						Thermostat, Room	Check that Thermostat Electrical Connections are secure. Adjust thermostat to required temperature setting.				

Table 3-1. Preventive Maintenance Checks and Services—Continued

Item number	Interval				B—Before operation		A—After operation		M—Monthly	
	Operator				D—During operation		W—Weekly		Q—Quarterly	
	Daily				M	Q	Item to be inspected	Procedure	Reference	
	B	D	A	W						
4	X						Noise and Vibration	Check unit for unusual noises and vibration. If severe, stop heater and refer to Organizational Maintenance.		
5				X			Mounting Bolts	Tighten heater mounting bolts, if loose.		
6				X			Fuel Filter	Inspect fuel for loose mtg and leakage.	Para 3-13	
7					X		Fuel Pump Filter	Service fuel pump filter.	Para 3-14	
8					X		Exhaust	Check for smoky exhaust and for erratic operation. Adjust fuel adjustment setting on carburetor to correct faulty operation.		
9					X		External Fuel Connections	Check fuel supply lines for cracks and leaks. Check threaded connectors for damage. Replace damaged part.		
10					X		Electrical Connectors and Electrical Wiring	Check for loose connections, damaged insulation, signs of overheating and other damage. Refer to direct support maintenance.		
11					X		Carburetor	Check for loose mounting, leaks and other damage. Adjust FUEL ADJUSTMENT setting on carburetor to correct faulty operation.	Para 3-15	
12					X		Thermocouple	Check thermocouple for loose mounting or defective operation. Tighten or replace damaged hardware. Clean Thermocouple. Replace defective thermocouple.		
13					X		Room Thermostat	Clean, inspect and test for correct operation. Replace if defective.	Para 3-28	
14					X		Overheat and Pre-Heat Thermostats	Check thermostats for loose or damaged electrical connections, loose mounting hardware, and defective operation. Tighten loose electrical conditions and mounting hardware. Clean if necessary. Replace defective thermostat.	Para 3-20	
15					X		Burner Housing	Inspect housing for cracks, dent, holes, corrosion, and other damage. Clean, if necessary.	Para 3-33	
16					X		Igniter Plug	Inspect igniter plug for defective operation; replace if defective.	Para 3-18	
17					X		Ignition Transformer	Inspect transformer for loose mounting or damaged connections. Tighten hardware if necessary. Check for overheating and damage. Replace damaged transformer.	Para 3-19	
18					X		Fuel Pump Power Supply	Check for visible damage, signs of overheating and faulty components. Replace if damaged.	Para 3-21	
19					X		Combustion Air Blower	Check for insecure mounting and improper operation. Tighten mounting hardware if loose. Replace blower if damaged.	Para 3-27	
20					X		Circulating Fan and Motor	Check for secure mounting and check that fan is secure on motor shaft. Tighten hardware if necessary. Check fan rotation by hand; fan must rotate freely without binding. Motor and fan must operate quietly, without vibration. Replace if damaged.	Para 3-26	

Table 3-1. Preventive Maintenance Checks and Services—Continued

Item number	Interval					B—Before operation		A—After operation		M—Monthly		
	Operator				Org.	D—During operation		W—Weekly		Q—Quarterly		
	Daily				M	Q	Item to be inspected		Procedure		Reference	
	B	D	A	W								
21						X	Control Box	Check for secure mounting. Check indi- cator lamps for proper operation. Check other components for visible damage, signs of overheating and other damage. Replace damaged components.		Para 3-25		

Section III. TROUBLESHOOTING

3-5. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the space heater and its components.

Malfunctions which may occur are listed in table 3-2. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause.

Table 3-2. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Heater fails to start and red lamp on control panel fails to glow	Power not connected to heater Fuse blown HEATER-FAN switch in OFF position HEATER-FAN switch defective	Connect heater to 120 volt power source (para 2-3). Change fuse (para 3-25b). Move HEATER-FAN to desired position (para 2-10). Check switch for continuity. If defective, replace HEATER-FAN switch (para 3-25). Connect to new fuel supply.
2. Heater fails to start or stops and red lamp on control panel glows	Fuel supply depleted Fuel filter clogged Fuel fuse blown Fuel pump faulty or dirty Fuel pump power supply defective Reset switch defective Overheat thermostat defective Ignition spark not present	Service fuel filter (para 3-13a). Replace fuse (para 3-25b). Disconnect fuel line at carburetor inlet; fuel should spurt out. If not, service fuel pump (para 3-14a). If this does not correct trouble, replace fuel pump (para 3-14). Check at fuel pump terminals for 24 volts dc. If power is not present, check power supply components and replace defective parts (para 3-21). Make sure leads are tight and in good condition. Open control box and check for continuity across terminals with switch depressed. Replace an open switch (para 3-25). Short across terminals of overheat thermostat. If heater cycles on, thermostat is defective. Replace defective thermostat (para 3-20). Remove lead from igniter and place lead 1/8 inch from a grounded surface. If spark is good, replace the defective igniter plug (para 3-18). Check ignition transformer and replace if defective (para 3-19). Check ignition resistor and replace if defective (para 3-19). Make sure leads are tight and in good condition.

Table 3-2. Troubleshooting—Continued

Malfunction	Probable cause	Corrective action
	Flame switch defective	Check for continuity and replace if defective (para 3-22).
	Flame switch thermocouple defective	Service the thermocouple; replace if defective (para 3-22).
	Fuel solenoid defective	Remove fuel adjusting needle; if fuel does not flow from orifice, solenoid is defective. Replace defective solenoid (para 3-15).
3. Heater fails to start, red lamp glows, and fuel flows from overflow tube	Carburetor needle valve sticking	Attempt to dislodge needle by striking sharply with handle of screwdriver. If this does not correct trouble, clean or replace carburetor (para 3-15).
4. Heater does not start, but white lamp glows	Room thermostat setting is too low	Set room thermostat just above the desired room temperature.
	Room thermostat wiring loose or incorrect	Check connections and wires for good condition.
	Room thermostat defective	Connect a voltmeter across the thermostat terminals and move the thermostat dial to its highest position. If voltage is not present, thermostat is defective; replace a defective thermostat (para 3-28).
5. Heater overheats	Overheat thermostat defective	Remove one lead from thermostat; if heater stops, thermostat is defective. Replace defective overheat thermostat (para 3-20).
6. Heater smokes	Fuel adjustment too high	Adjust fuel flow (para 3-15d).
	Carburetor float loaded	Replace carburetor float bowl assembly (para 3-15).
7. Heater backfires	Carburetor fuel adjustment incorrect	Adjust fuel adjusting needle (para 3-15d).
	Igniter spark weak	Remove lead from igniter plug and check for spark on grounded part of heater. If spark is good, igniter is defective. Replace defective igniter. Check ignition transformer and replace if defective (para 3-19). Check ignition resistor and replace if defective (para 3-19). Check leads and connections for good condition.
8. Heater floods while off	Exhaust system obstructed	Locate and remove obstruction. Check that exhaust is short and direct.
	Fuel solenoid valve defective	Test solenoid valve and replace if defective (para 3-15).
9. Circulating air motor does not start	Flame switch defective	Remove cover, check for continuity, and replace relay if defective (para 3-22).
	Flame switch thermocouple defective	Service the thermocouple; replace if defective (para 3-22).
	HEATER-FAN switch defective	Check switch for continuity. If defective, replace HEATER-FAN switch (para 3-25).
	Motor defective	Apply 120 ac volts to the motor leads. If motor does not start, it is defective. Replace defective motor (para 3-26).

Section IV. FIELD EXPEDIENT REPAIRS

3-6. General

Organizational maintenance level troubles may occur while the space heater is operating in the field where supplies and repair parts are not available and normal corrective action cannot be performed. When this condition exists, the following expedient repairs may be used in emergencies, upon the decision of the unit Commander. Equipment so repaired must be removed from operation as soon as possible and properly repaired before being placed in operation again.

3-7. Heater Fails to Start

Trouble	Expedient remedy
Room thermostat defective	Disconnect thermostat cable from heater. Install jump-

Trouble

Expedient remedy

er across terminals A and C of ROOM THERMOSTAT receptacle. Control operation of heater by operating control switch.

Warning: Dangerous voltage can exist at the ROOM THERMOSTAT receptacle when power is applied to heater. Make sure heater is deenergized before installing jumper.

Overheat thermostat defective (circuit open)

Disconnect leads from overheat thermostat and connect leads together to make good electrical contact.

Section V. RADIO INTERFERENCE SUPPRESSION

3-8. General Methods Used to Attain Proper Suppression

Essentially, suppression is attained by providing a low resistance path to ground for the stray currents. The methods used include shielding the ignition and high-frequency wires, grounding the frame with bonding straps, and using capacitors and resistors.

3-9. Interference Suppression Components

a. Primary Suppression Components. The primary suppression components are those whose primary function is to suppress radio interference. These components are described and located in figure 3-1.

b. Secondary Suppression Components. These components have radio interference suppression functions which are incidental or secondary to their primary function.

3-10. Replacement of Suppression Components

a. Refer to figure 3-1 and replace the radio interference suppression components.

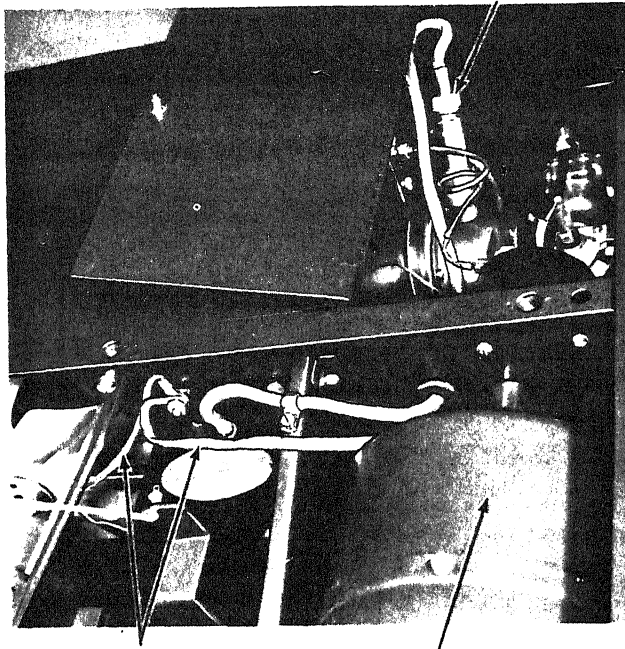
b. If shielded ignition cable from the ignition transformer is damaged, replace the ignition transformer (para 3-19).

3-11. Testing of Radio Interference Suppression Components

If interference is indicated, isolate the cause of the interference by tightening the connections of all ground leads and by checking the resistor with a multimeter. If a multimeter is not available, substitute a new resistor. If these steps fail to clear up the interference report the condition to direct support maintenance for possible replacement of the combustion blower motor radio interference suppression capacitors.

NOTE: LOOSEN CABLE NUT AND DISCONNECT
CABLE TO REMOVE RESISTOR.

CERAMIC RESISTOR,
SPECIAL CONTACT,
5K (+50-15) OHM.
(INSIDE CONNECTOR)



GROUND LEADS.
REMOVE HARDWARE
TO REMOVE LEADS.

COMBUSTION MOTOR HAS
INTERNAL SUPPRESSION
CAPACITORS REPLACEABLE
AT DIRECT SUPPORT
MAINTENANCE LEVEL.

MEC 4520-233-14/3-1

*Figure 3-1. Interference suppression components, removal
and installation.*

Section VI. FUEL SYSTEM

3-12. General

a. The heater fuel system (fig. 3-2) is designed for burning gasoline conforming to Specification MIL-G-3056, Specification VV-G-76, and any other gasoline (leaded or aromatic) up to 100 octane grade and with diesel fuel conforming to Specification VV-F-800, Class DF-1, DF-2, or DF-A having a cloud point not lower than -55°F . A fuel filter at the fuel entry strains the fuel. A plunger-type fuel pump provides a constant flow of fuel to the burner head for combustion at the call of the controls. Included in the system are a float bowl assembly, electric pump, and solenoid valve.

b. Fuel is drawn through the fuel filter and inlet line into the fuel pump which contains a removable strainer screen and a plunger-type pump. Fuel flows from the pump to the float bowl and solenoid valve. The action of the float keeps the fuel at a constant level in the float bowl. Flooding of the heater, due to external pressure buildup when the heater is not burning, is prevented electrically by the solenoid valve, and mechanically by the needle valve in the body under the float bowl.

c. As long as the fuel solenoid valve is energized, fuel from the float bowl enters the jet which directs the fuel flow to the mixer housing. In the mixer housing, the fuel stream is atomized

and mixed with the combustion air flow. The combustion chamber where it is ignited by a continuous spark from the igniter plug.

3-13. Fuel Filter

a. Service. Open the right side access door and service the fuel filter as illustrated in figure 3-3.

b. Removal and Disassembly.

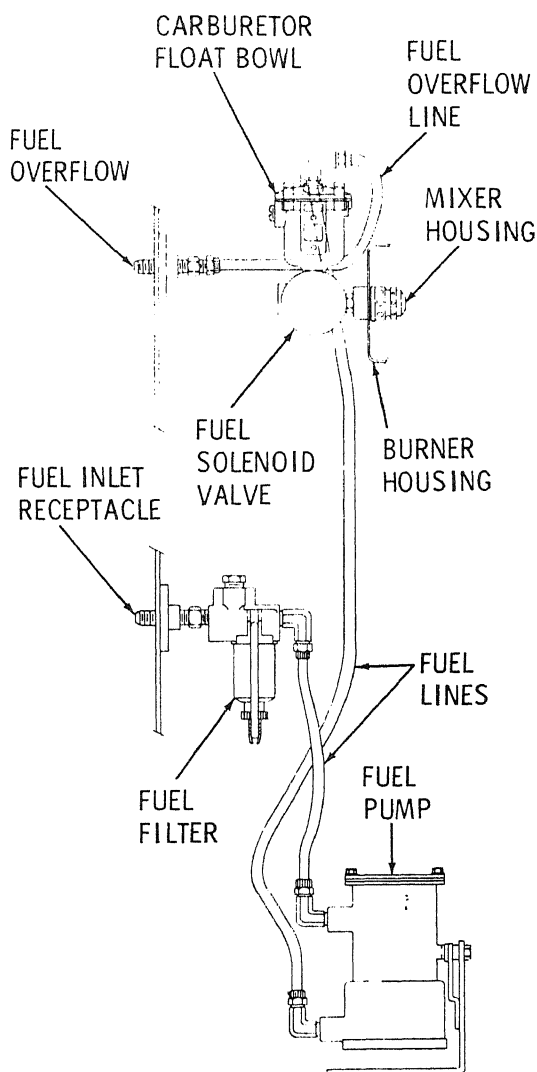
(1) Open front access door and right side access door (fig. 1-1).

(2) Remove the fuel filter as illustrated in figure 3-3.

c. Reassembly and Installation.

(1) Install the fuel filter as illustrated in figure 3-3.

(2) Close the front and right side access doors.



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Figure 3-2. Fuel system, schematic diagram.

3-14. Fuel Pump

a. Service. Remove the right side panel (fig. 1-1) and service the fuel pump as illustrated in figure 3-4.

b. Removal and Disassembly.

(1) Remove the right side panel (fig. 1-1) from the housing.

(2) Remove the fuel pump as illustrated in figure 3-5.

c. Reassembly and Installation.

(1) Remove the carburetor as illustrated in figure 3-5.

(2) Install the right side panel (fig. 1-1).

3-15. Carburetor

a. Removal and Disassembly.

(1) Remove the carburetor as illustrated in figure 3-6.

(2) Disassemble the carburetor float bowl, mixer housing, and heater as illustrated in figure 3-7.

b. Cleaning and Inspection.

(1) Wipe outside of coil with a damp cloth. Wipe dry.

(2) Check operation of needle valve in carburetor. It must move freely. Replace if defective.

(3) Connect electrical leads of solenoid coil to a 24-volt dc source and check operation. Replace defective coil.

(4) Inspect carburetor float for fuel logging. If fuel float is not sealed, replace float bowl assembly.

(5) Inspect element in the carburetor for tears, embedded foreign matter, or other damage. Replace if damaged.

(6) Inspect surface of fuel adjusting needle and seat in body. If either shows nicks, scores, or damage, both should be replaced.

(7) Inspect bore in top of jet. Replace damaged jet.

(8) Check opening around outlet of mixer housing for damage, deformation, or enlarged spots. If opening is damaged, replace mixer housing.

(9) Inspect all parts for breaks, cracks, pits, scoring, damaged threads, or other damage. Replace damaged parts.

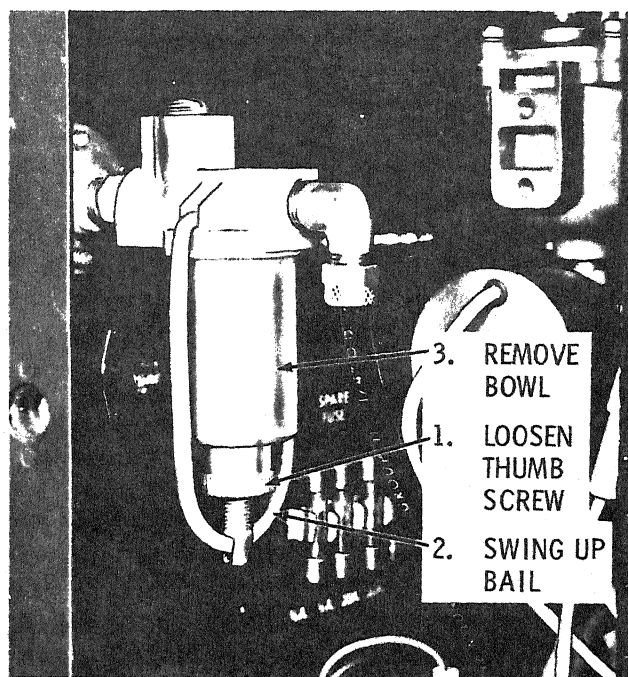
c. Reassembly and Installation.

(1) Reassemble the carburetor float bowl, solenoid valve, and mixer housing as illustrated in figure 3-7.

(2) Install the assembled carburetor as illustrated in figure 3-6.

(3) Adjust the fuel flow as directed in subparagraph *d*, below.

NIPPLE



SERVICE: REMOVE BOWL AND GASKET. EMPTY BOWL AND CLEAN WITH APPROVED CLEANING SOLVENT. DRY THOROUGHLY AND REASSEMBLE. IF FILTER ELEMENT IS DIRTY, REMOVE AND CLEAN AS INDICATED IN PARAGRAPH 3-17.

REMOVAL: DISCONNECT FUEL LINE.
TURN FILTER ASSEMBLY FROM NIPPLE.

MEC 4520-233-14/3-3

Figure 3-3. Fuel filter service, removal and installation.

d. Fuel Adjustment.

(1) Whenever fuel adjusting needle has been removed, or if the heater smokes or operates erratically, adjusting needle should be adjusted.

(2) Turn fuel adjustment needle clockwise until it is seated.

Caution: Do not force fuel adjusting needle as this may damage the fuel metering orifice and make correct adjustment difficult or impossible.

(3) Connect thermostat, fuel, and power to heater. Set thermostat above ambient temperature and operate control switch to HEATER position.

(4) Turn FUEL ADJUSTMENT needle (fig. 3-8) counterclockwise slowly, in 1/8 turn increments, until the space heater operates smoothly without smoking and without an odor of burned fuel in the exhaust.

Warning: Do not operate the space heater in an enclosed area without piping the exhaust to the outside. The exhaust contains carbon monoxide, a colorless, odorless, deadly poisonous gas.

3-16. Fuel Lines

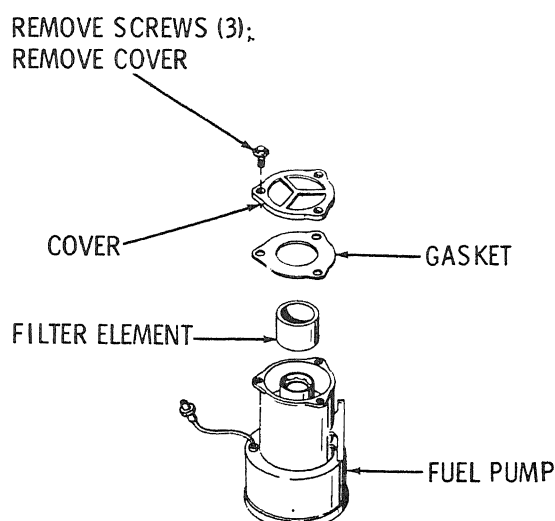
a. Removal. Remove fuel lines from the fuel system as necessary for cleaning, inspection, or replacement. Refer to figures 3-5 and 3-6 for fuel lines and major components.

b. Cleaning and Inspection.

(1) Clean tubes and fittings in an approved cleaning solvent; dry thoroughly.

(2) Inspect all metal parts for damaged threads, obstructions, kinks or bends, cracks, or other damage. Replace if damaged.

c. Installation. Install any fuel lines that were removed for cleaning and inspection. Refer to figures 3-5 and 3-6.



SERVICE:

- STEP 1. REMOVE COVER, FILTER ELEMENT, AND GASKET.
- STEP 2. WASH ELEMENT IN CLEAN SOLVENT. BLOW OUT DIRT AND DRY WITH LOW PRESSURE (20 P. S. I.) COMPRESSED AIR.
- STEP 3. REASSEMBLE.

ME 4520-233-14/3-4

Figure 3-4. Fuel pump service.

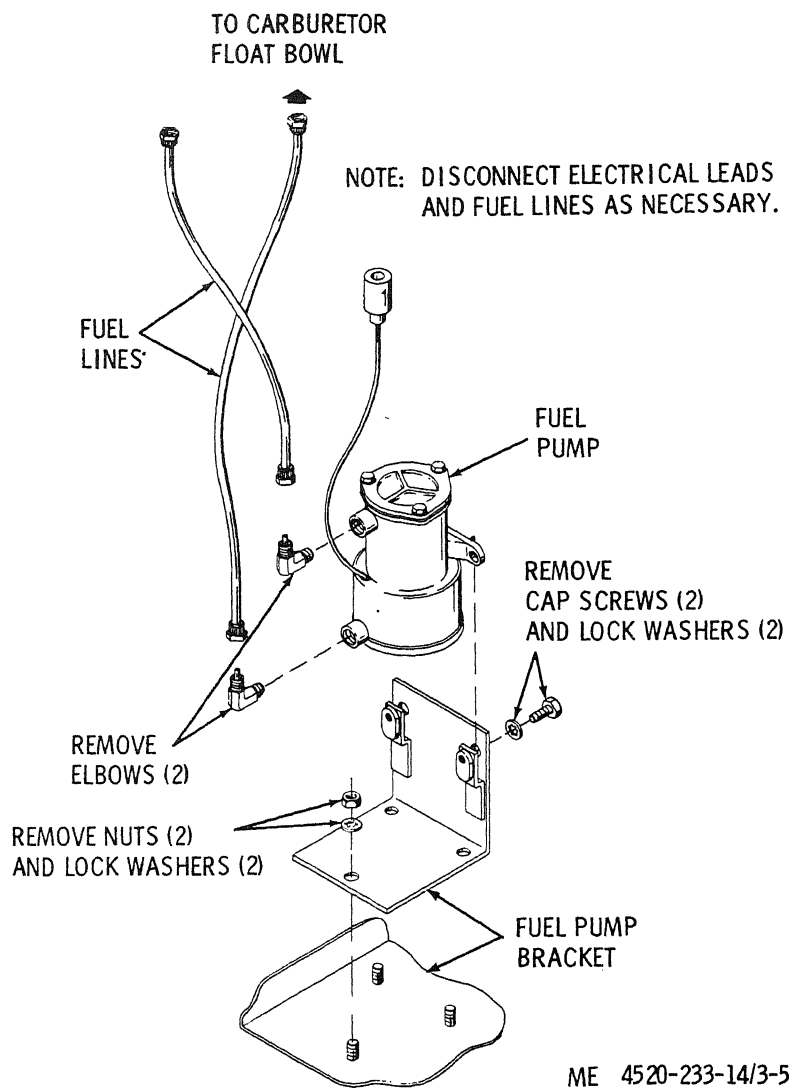
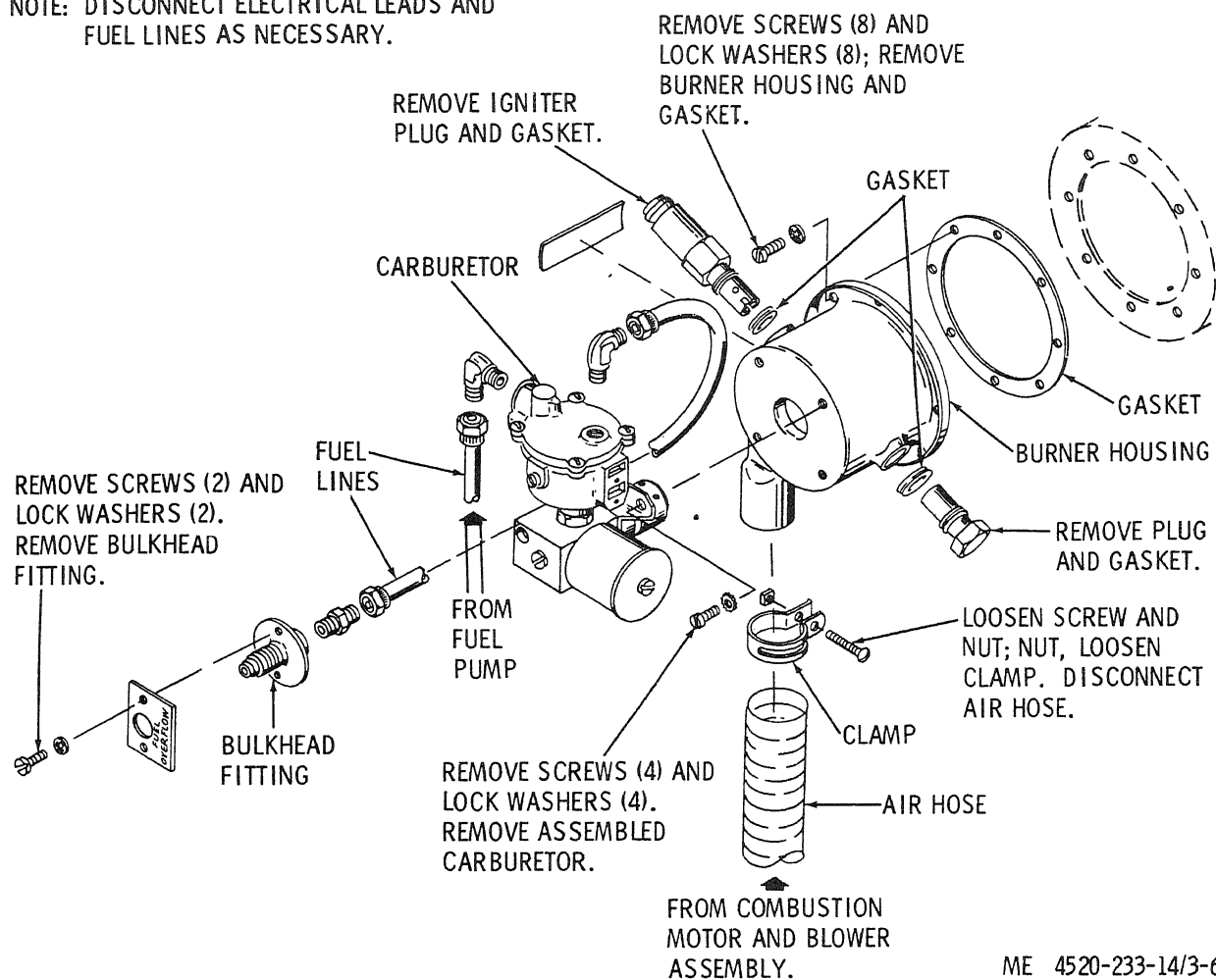


Figure 3-5. Fuel pump, removal and installation.

NOTE: DISCONNECT ELECTRICAL LEADS AND FUEL LINES AS NECESSARY.

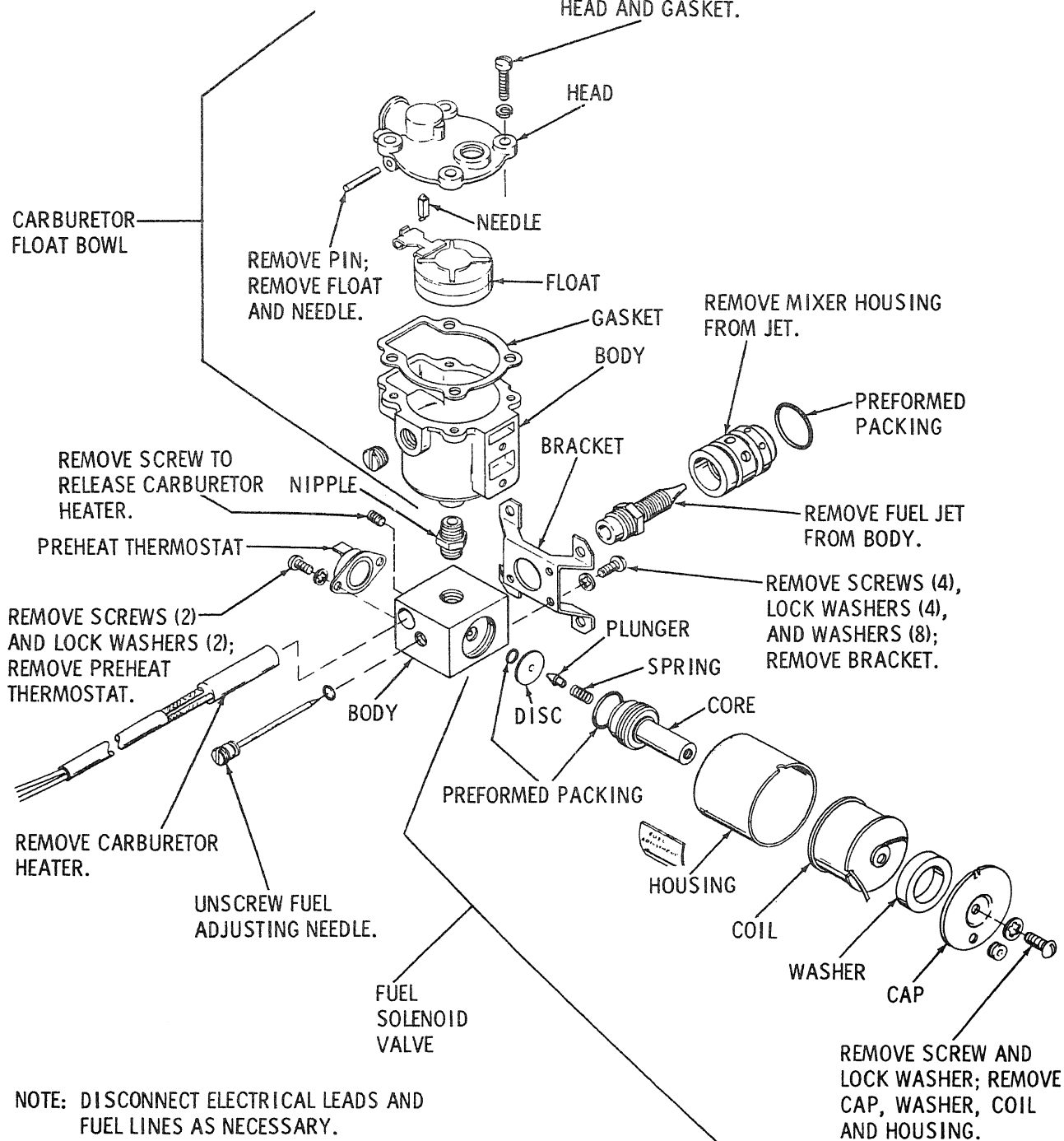


ME 4520-233-14/3-6

Figure 3-6. Carburetor and burner housing, removal and installation.

NOTE: CHECK OPERATION OF SOLENOID COIL BEFORE DISASSEMBLY OF FUEL SOLENOID VALVE.

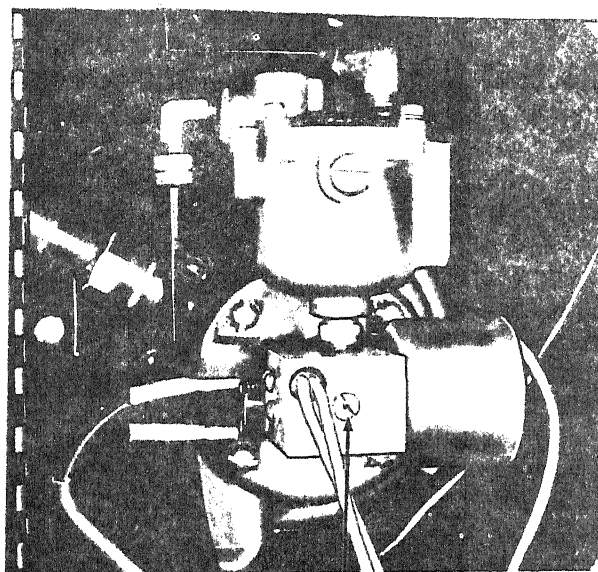
REMOVE SCREWS (4) AND LOCK WASHERS (4); REMOVE HEAD AND GASKET.



ME 4520-233-14/3-7

Figure 3-7. Carburetor float bowl, solenoid valve, mixer housing, and heater, disassembly and reassembly.

- STEP 1. START HEATER (PARA. 2-10). ALLOW IT TO WARM TO OPERATING TEMPERATURE.
- STEP 2. TURN FUEL ADJUSTMENT NEEDLE UNTIL SMOKING OR ERRATIC OPERATION STOPS. TURN ONLY IN INCREMENTS OF ONE-EIGHTH TURN. IF HEATER SMOKES, TURN NEEDLE CLOCKWISE. IF HEATER OPERATES ERRATICALLY, TURN NEEDLE COUNTER-CLOCKWISE.



FUEL
ADJUSTMENT
NEEDLE

MEC 4520-233-14/3-8

Figure 3-8. Fuel adjustment.

Section VII. ELECTRICAL SYSTEM

3-17. Description

a. General. The heater electrical system (fig. 3-9) controls the heater on-off cycle, provides the spark for fuel ignition in the combustion chamber, and provides a 24-volt dc power supply to the fuel pump.

b. Ignition Circuit. The ignition circuit consists of the ignition transformer which steps up the 120-volt ac input to 5000 volts ac, to furnish power for a spark to jump the electrodes of the igniter plug. The circuit is energized whenever the control switch is in the HEATER position and the room thermostat is calling for heat. A 20-ampere fuse protects the circuit from an over-

load. If the reset switch in the circuit opens, the red indication light will glow.

c. Fuel Pump Power Supply. The fuel pump power supply consists of a transformer that steps down the 120 volt ac input to 24 volts ac. This voltage is connected across a full wave-bridge rectifier which converts the 24-volt ac power on 24-volt dc power, actuate the fuel pump and fuel solenoid. A separate 1/2-ampere fuse protects the 24-volt circuit. This circuit is energized whenever the reset switch is closed, the room thermostat is calling for heat, and the overheat thermostat is closed.

d. Electrical Operating Sequence.

(1) With power applied to the POWER receptacle, the control switch in the HEATER position, and the room thermostat calling for heat, the AC circuit is traced from the pin of the POWER receptacle, through the 20-ampere fuse, through the normally closed RESET switch, through the control switch in the HEATER position, to the white indicator lamp. It also proceeds through the closed contacts of the room thermostat, through the overheat thermostat to the 24-volt power supply to energize the fuel pump and solenoid valve which supply fuel to the carburetor.

(2) From the room thermostat, a second circuit is traced through the normally closed contacts of the control relay to energize the combustion air motor and the ignition transformer. With fuel, ignition arc, and combustion air supplied to the burner, ignition should occur.

(3) When combustion occurs, the heated thermocouple generates current sufficient to close through a voltage-dropping resistor to the full-wave rectifier. The DC output of the rectifier energizes the control relay which then closes the circuits to the combustion motor and ignition transformer, bypassing the control switch. The circulating air motor is also energized through the control relay to provide circulated heated air.

(4) When the control switch is moved to the OFF position or when the room thermostat opens because its heat requirements are satisfied, the electrical supply to the low-voltage power supply is deenergized, and the fuel pump and solenoid deenergize to interrupt the fuel flow to the carburetor. The ignition transformer, and combustion air motor continue to run, held energized through the control relay, to purge all fumes or gases from the burner. The circulating air motor also continues to run (held energized through the control relay) to properly reduce the temperature of the heat exchanger. When the fuel is all burned and the flame goes out, the loss of heat is sensed by the flame switch thermocouple and the flame switch relay contacts open to deenergize the control relay and stop all heater operation.

(5) In the event that combustion does not occur at the start, the flame switch relay will not operate and the time delay heating element heats enough to operate the normally closed RESET switch. This breaks the circuit to the combustion air motor, ignition transformer, and low-voltage power supply to stop operation, and energizes the red indicator lamp to indicate a malfunction.

(6) If the flame goes out during operation, the flame switch relay opens to deenergize the control relay. The control relay energizes the time-delay circuit, causing the time delay element to heat, opening the RESET switch to stop heater operation as described in (5), above.

(7) If an overheat condition occurs in the heater, the condition is sensed by the overheat thermostat which opens to deenergize the low voltage power supply and shuts off the fuel supply to the burner.

(8) In cold weather, the fuel thermostat closes to close the circuit to the fuel heater when the control switch is in the HEATER position. When the fuel heats to the preset temperature of the thermostat, the thermostat opens to deenergize the heater in the carburetor.

(9) When the control switch is operated to the FAN position, the circuit is closed directly to the circulating air motor. The motor continues to run until the switch position is restored to OFF.

3-18. Igniter Plug

a. Removal.

(1) Open the front and left side access doors.

(2) Remove the igniter plug as illustrated in figure 3-6.

b. Cleaning and Inspection.

(1) Clean the igniter plug with a cloth dampened with an approved cleaning solvent.

(2) Inspect the tip and outer shell for burning and pitting. Inspect ceramic parts for cracks or breaks. Inspect threads for damage. Replace a damaged or burned igniter plug.

(3) Inspect the igniter plug gasket for cracks or other damage: replace if damaged.

c. Installation.

(1) Install the igniter plug as illustrated in figure 3-6. Make sure the suppression resistor (fig. 3-10) is installed.

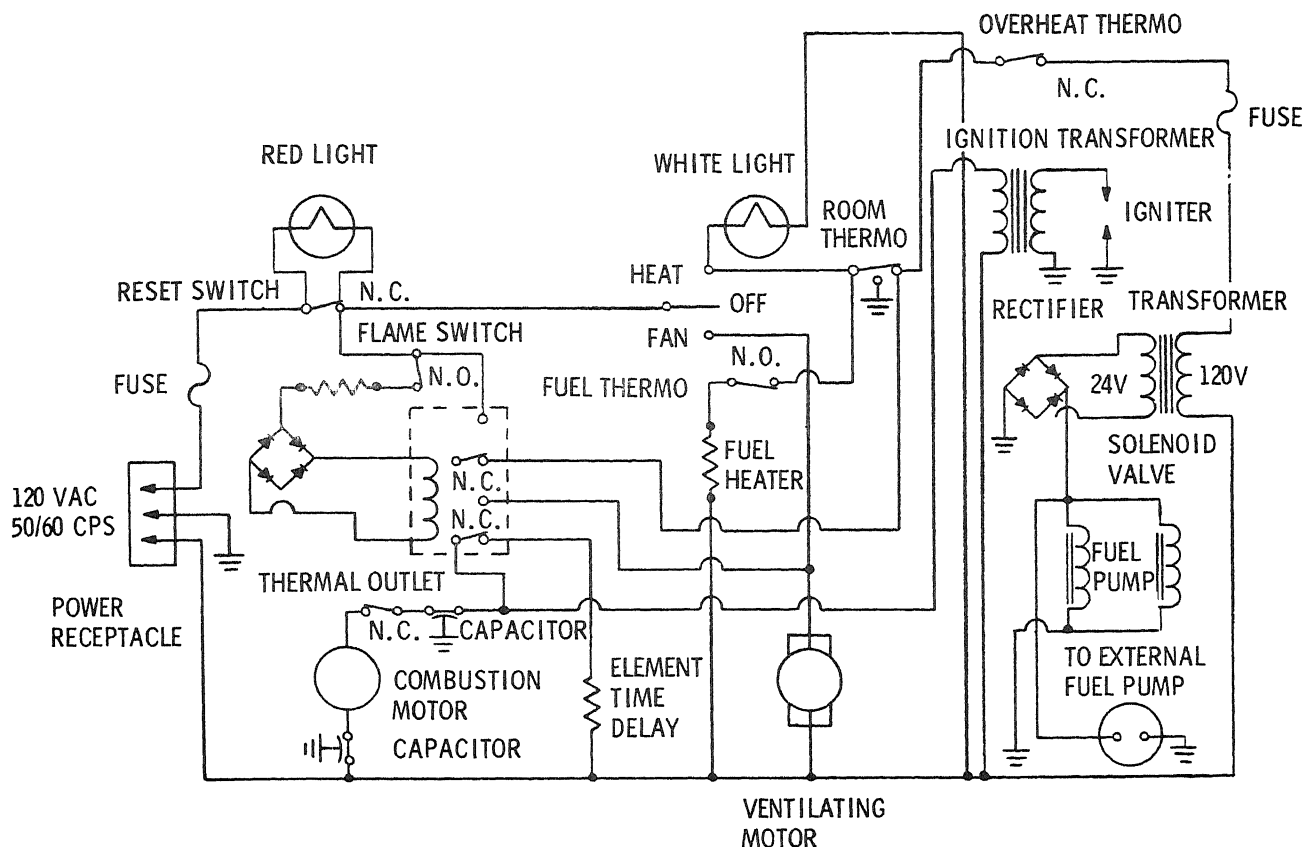
(2) Close the front and left side access doors.

3-19. Ignition Transformer

a. Removal.

(1) Open the front and left side access doors and remove the left side panel.

(2) Remove the ignition transformer as illustrated in figure 3-10. Take care not to lose the suppression resistor when disconnecting the sheathed cable from the igniter plug.



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Figure 3-9. Electrical schematic diagram.

b. Cleaning and Inspection.

(1) Wipe outside of ignition transformer and electrical leads with a cloth dampened with an approved cleaning solvent. Take care not to get cleaning solvent inside transformer or suppression resistor.

(2) Clean all non-electrical parts in cleaning solvent: dry thoroughly.

(3) If ignition transformer shows signs of overheating or malfunctioning, replace ignition transformer.

(4) Use a multimeter to check for continuity across the primary and secondary windings at the transformer. When checking continuity secondary windings, check across the output lead and an unpainted portion of the transformer case. Continuity must exist across both sets of windings.

(5) Check ignition suppression resistor for damage or broken or deformed spring in either lead end or resistor. Use a multimeter to check resistance. It shall be 5K (+50-50) ohms. Replace a defective resistor.

c. Installation.

(1) Install the ignition transformer as il-

lustrated in figure 3-10. Make sure the suppression resistor is installed between the shielded cable and igniter plug.

(2) Close the front and left side access doors and install the left side panel.

3-20. Overheat and Preheat Thermostats

a. Removal.

(1) Open the front, left, and right side access doors.

(2) Remove the overheat thermostat as illustrated in figure 3-11.

(3) Remove the preheat thermostat from the carburetor as illustrated in figure 3-7.

b. Cleaning, Inspection, and Testing.

(1) Clean the thermostats with a cloth dampened with an approved cleaning solvent: dry thoroughly.

(2) Clean all other parts with cleaning solvent, dry thoroughly.

(3) Inspect the overheat thermostat and preheat thermostat for cracks, dents or other visible damage, signs of overheating, and for loose or broken terminals: replace damaged thermostats.

NOTE: DISCONNECT ELECTRICAL LEADS, AS NECESSARY.

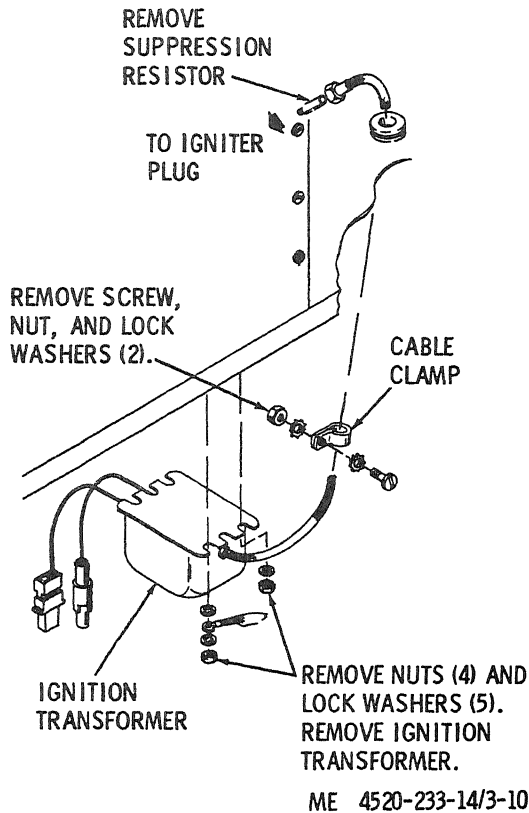


Figure 3-10. Ignition transformer and suppression resistor, removal and installation.

(4) To test the overheat thermostat, use heat resistant, insulated wire to connect it in series with a multimeter adjusted to read resistance. At normal temperature, the circuit through the thermostat shall be closed. Place the thermostat and an accurate thermometer in an oven and heat the oven. Watch the multimeter to determine the point at which the thermostat opens. This shall occur between 263° and 277° F. Turn off the oven and open the door slightly to allow the heat to dissipate. Watch the multimeter to determine the point at which the thermostat closed. This shall occur between 237° and 253° F. Replace the thermostat if it fails to operate within these limits.

(5) To test the preheat thermostat, connect it in series with a multimeter adjusted to read resistance. At normal temperature, the circuit through the thermostat shall be open. Place the thermostat and an accurate thermometer in a cold box. Operate the cold box and watch the multimeter to determine the point at which the thermo-

stat closes. This shall occur between 24 and 36° F. Shut off the cold box and open the cold box door to allow heat to enter. Watch the multimeter to determine the point at which the thermostat opens. This shall occur between 40 and 50°F. Replace the thermostat if it fails to operate within these limits.

(6) Inspect all other parts for cracks, worn or damaged threads, and other damage; replace damaged parts.

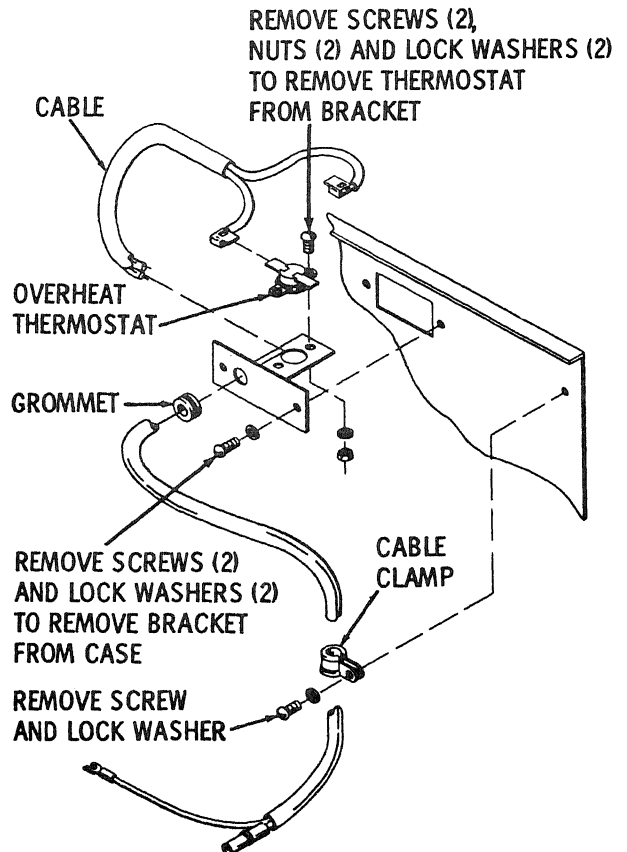
c. Installation.

(1) Install the preheat thermostat as illustrated in figure 3-7.

(2) Install the overheat thermostat as illustrated in figure 3-11.

(3) Close the front, left, and right access doors.

NOTE: DISCONNECT ELECTRICAL LEADS AS NECESSARY.



ME 4520-233-14/3-11

Figure 3-11. Overheat thermostat, removal and installation.

3-21. Fuel Pump Power Supply

a. Fuse Replacement. If troubleshooting procedures indicate that the 1/2-ampere fuse is defective, replace it as illustrated in figure 3-12. Always correct the cause of the overload before replacing the fuse.

b. Removal and Disassembly.

(1) Open the front and right side access panels.

(2) Remove the fuel pump power supply as illustrated in figure 3-13.

(3) Disassemble the fuel pump power supply as illustrated in figure 3-14.

c. Cleaning and Inspection.

(1) Clean electrical parts with a damp cloth; dry thoroughly.

(2) Clean all other parts in cleaning solvent; dry thoroughly.

(3) Inspect transformer for malfunction or defects. Connect the primary of transformer (black leads) to a 120-volt ac supply and measure output of secondary (red leads); it should be approximately 30 volts. Replace transformer if it is damaged or defective.

(4) Inspect fuse for good condition; replace if defective.

(5) Inspect the rectifier for cracks, broken leads and signs of overheating. Replace a damaged rectifier.

(6) Inspect all electrical leads for broken or damaged insulation, worn, burned, or loose terminals, cracks, breaks, or other damage; replace if damaged.

(7) Inspect all of the parts for worn threads, cracks, breaks, or other damage; replace if damaged.

d. Reassembly and Installation.

(1) Reassemble the fuel pump power supply as illustrated in figure 3-14.

(2) Install the fuel pump power supply as illustrated in figure 3-13.

(3) Close the front and right side access doors.

3-22. Flame Switch, Resistor, and Thermocouple

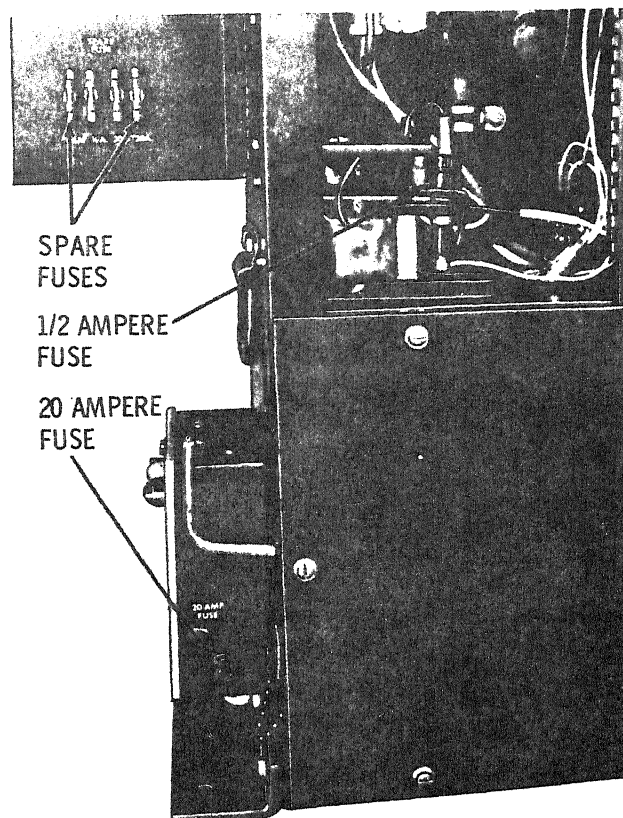
a. Removal.

(1) Open the front and left side access doors.

(2) Remove the flame switch, resistor, and thermocouple as illustrated in figure 3-15.

b. Cleaning and Inspection.

(1) Wipe terminals, cover, and box of flame switch relay with a cloth dampened in cleaning



MEC 4520-233-14/3-12

Figure 3-12. Fuse replacement.

solvent; dry thoroughly. Take care not to get solvent in covered parts of relay.

(2) Clean thermocouple with a cloth dampened in cleaning solvent. Clean and polish end of thermocouple with a fine grit stone. Make sure all abrasive is removed from the end by rubbing with cleaning solution after polishing.

(3) Wash all other parts except insulation with cleaning solvent; dry thoroughly.

(4) Inspect flame switch for damage; replace if damaged or defective.

(5) Inspect thermocouple for pits, cracks, breaks, or other damage; replace if damaged.

(6) Inspect insulation for cracks or tears: replace if damaged. Inspect all other parts for wear, damaged threads, breaks, cracks, or other damage: replace if damaged.

(7) Inspect resistor for cracks or damage. Check resistance with multimeter. Resistance must be approximately 800 ohms.

c. Installation.

(1) Install the flame switch, resistor, and thermocouple as illustrated in figure 3-15.

(2) Close the front and left side access doors.

NOTE: DISCONNECT ELECTRICAL LEADS AS NECESSARY.

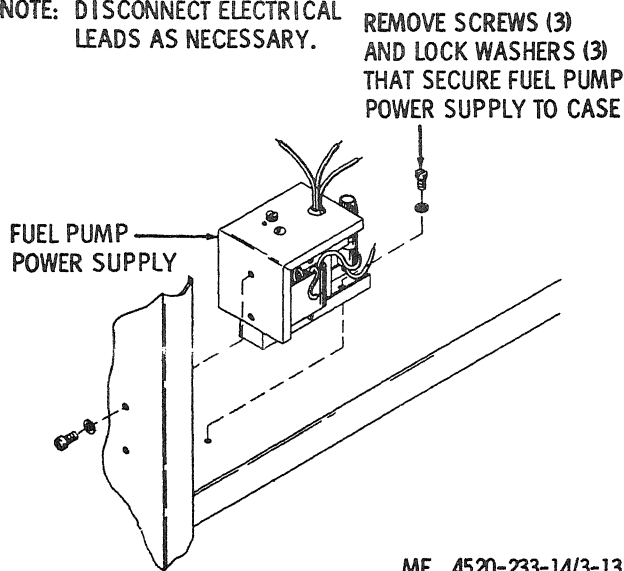


Figure 3-13. Fuel pump power supply, removal and installation.

3-23. Pump Receptacle and Power Receptacle

a. Removal.

- (1) Remove the right side panel.
- (2) Remove the pump receptacle and power receptacle as illustrated in figure 3-16. Tag all leads to facilitate reassembly.

b. Cleaning and Inspection.

- (1) Wipe the parts of the pump receptacle and power receptacle with a cloth dampened with an approved cleaning solvent; dry thoroughly.
- (2) Inspect the receptacles for cracks, break bent and broken pins and lugs, damaged threads, and other damage; replace damaged receptacles.

c. Installation.

- (1) Install the pump receptacle and power receptacle as illustrated in figure 3-16. Refer to the wiring diagram (fig. 1-3), if necessary, when connecting electrical leads.
- (2) Install the right side panel.

3-24. Terminal Strip

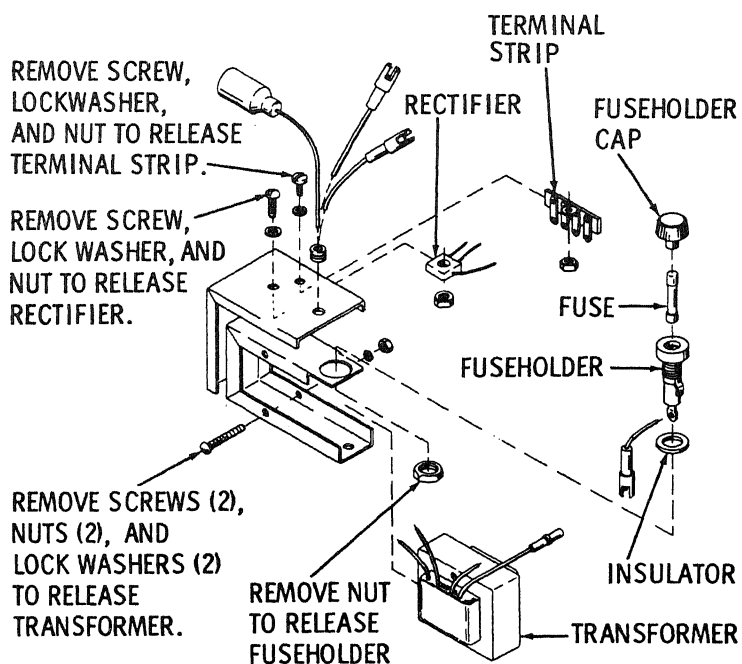
a. Removal.

- (1) Open the front, left, and right access doors.
- (2) Remove the terminal strip as illustrated in figure 3-17. Tag leads to facilitate reassembly.

b. Cleaning and Inspection.

- (1) Wipe terminal strip and marker with a cloth dampened with cleaning solvent; dry thoroughly.
- (2) Inspect terminal strip for cracks, broken or damaged terminals, or other damage; replace if damaged.

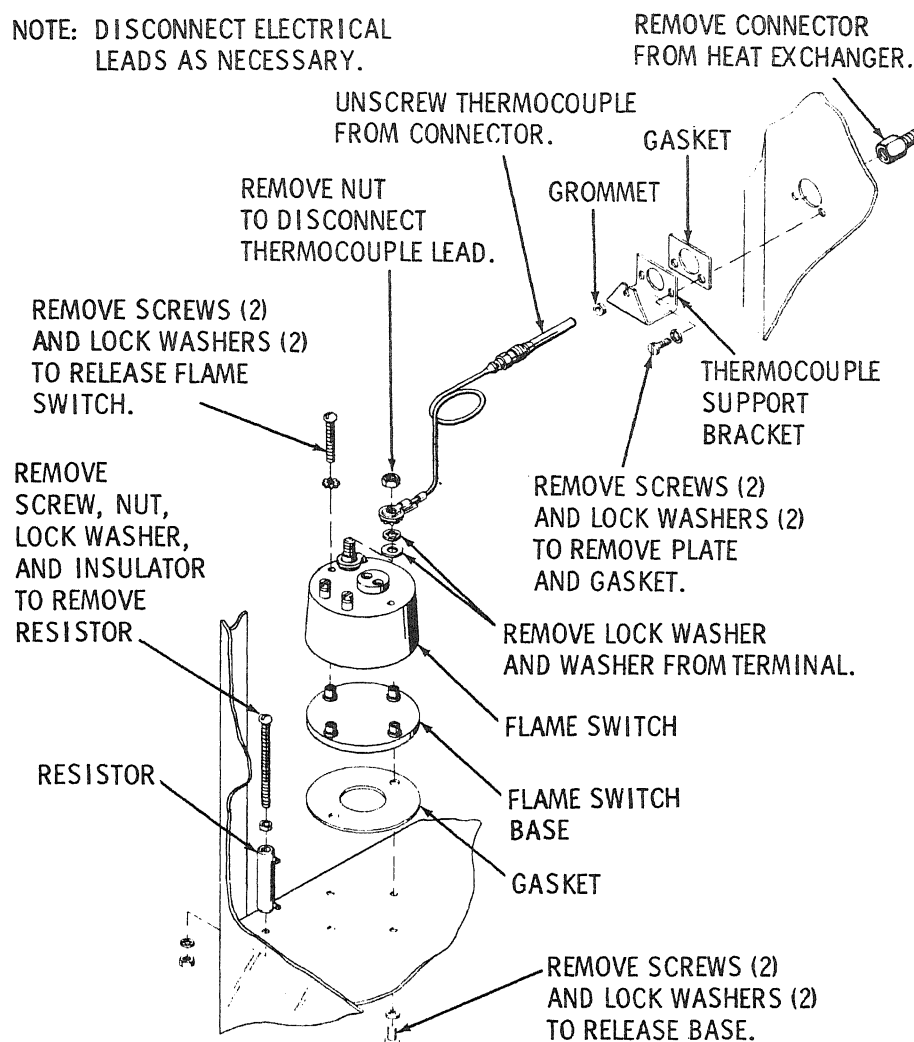
NOTE: UNSOLDER AND DISCONNECT ELECTRICAL LEADS AS NECESSARY.



ME 4520-233-14/3-14

Figure 3-14. Fuel pump power supply, disassembly and reassembly.

NOTE: DISCONNECT ELECTRICAL LEADS AS NECESSARY.



ME 4520-233-14/3-15

Figure 3-15. Flame switch and thermocouple, removal and installation.

(3) Inspect terminal strip marker for legibility or damage; replace if illegible or damaged.

c. Installation.

(1) Install the terminal strip as illustrated in figure 3-17. Refer to figure 1-3 for electrical connections.

(2) Close the front, left, and right access doors.

3-25. Control Box

a. Indicator Lamp Replacement. Replace burned-out indicator lamps as illustrated in figure 3-18.

b. Control Box Fuse Replacement. Replace a blown fuse as illustrated in figure 3-12. Correct the cause of the overload before replacing the fuse.

c. Removal and Disassembly.

(1) Remove the control box as illustrated in figure 3-18.

(2) Disassemble the control box as illustrated in figure 3-19.

d. Cleaning and Inspection.

(1) Wipe all electrical parts and nonmetallic parts with a cloth dampened with cleaning solvent; dry thoroughly.

(2) Clean all other parts with cleaning solvent; dry thoroughly.

(3) Inspect reset switch by depressing switch button and checking for continuity across switch terminals. Replace an open switch.

(4) Check across terminals of the time delay element for continuity. Inspect element visually.

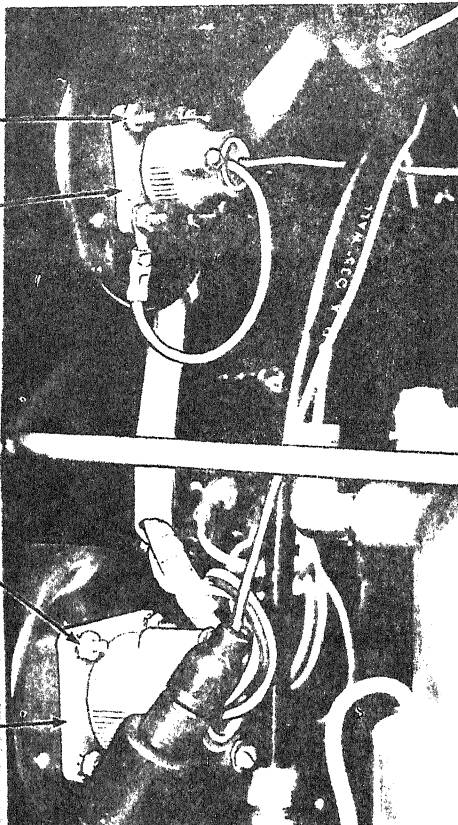
NOTE: UNSOLDER AND DISCONNECT
ELECTRICAL LEADS AS NECESSARY.

REMOVE SCREWS (4),
NUTS (4), AND LOCK
WASHERS(4) TO
REMOVE RECEPTACLE.

PUMP
RECEPTACLE

REMOVE SCREWS (4),
NUTS (4), AND LOCK
WASHERS (4) TO
REMOVE RECEPTACLE

POWER
RECEPTACLE



NOTE: ONE MOUNTING SCREW ON EACH
RECEPTACLE HOLDS RECEPTACLE
CAP CHAIN TO FRONT OF CASE.
INSTALL CHAIN AT REASSEMBLY.

MEC 4520-233-14/3-16

Figure 3-16. Pump receptacle and power receptacle, removal and installation.

With element connected to rest switch (fig. 3-19); apply 120-volt ac power to reset switch terminals; time delay element should glow red. In any of these checks indicate defects or damage, replace time delay element.

(5) Check for continuity across terminals of control switch in HEATER and FAN positions. Inspect switch for visible damage, cracks, breaks, or corroded terminals; replace if damaged or defective.

(6) Check lamps for good condition and light bodies for cracks, damaged socket, or deteriorated or worn leads. Replace damaged or defective lamps or light bodies.

(7) Inspect female receptacle and male plug for cracks, damaged or worn heads or terminals

bent or deformed prongs or contact inserts, or other damage; replace if damaged.

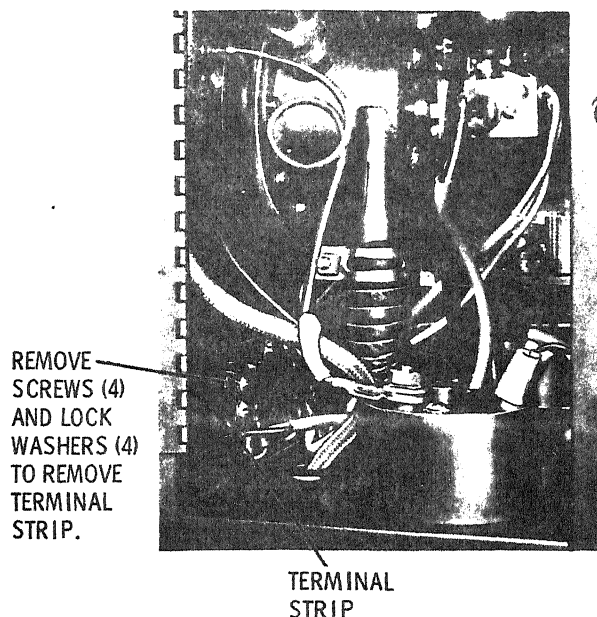
(8) Inspect fuse for good condition; replace if defective.

(9) Inspect fuse holder and cap for cracks, broken or damaged socket or bayonet, damaged, bent, or broken terminal. Replace if damaged.

(10) Inspect lenses for scratches, cracks, or other damage; replace if damaged.

(11) Inspect control relay for cracked case, broken terminals, signs of overheating and other damage. Refer to the relay schematic diagram in figure 3-20 for terminal identification. Check resistance between terminals 4 and 5. It should be 300 ohms. Check for continuity between terminals 6 and 2 and between 3 and 7. Continuity

NOTE: DISCONNECT ELECTRICAL LEADS AS NECESSARY.



MEC 4520-233-14/3-17

Figure 3-17. Terminal strip, removal and installation.

shall exist. Apply approximately 26.5 volts dc between contacts 4 and 5. This must cause relay to trip, establishing continuity between terminals 6 and 1 and between 3 and 8. Replace damaged or inoperative relay.

(12) Inspect rectifier CR2 for cracks, broken terminals, signs of overheating and other damage. Replace damaged rectifier.

(13) Inspect all other parts for cracks, breaks, damaged threads, worn or scratched finish, and other damage. Repair damaged finishes; replace damaged parts.

e. Reassembly and Installation.

(1) Reassemble the control box as illustrated in figure 3-19. Refer to figure 1-3 for information regarding the connection of wires.

(2) Install the control box as illustrated in figure 3-18.

3-26. Circulating Air Motor and Fan

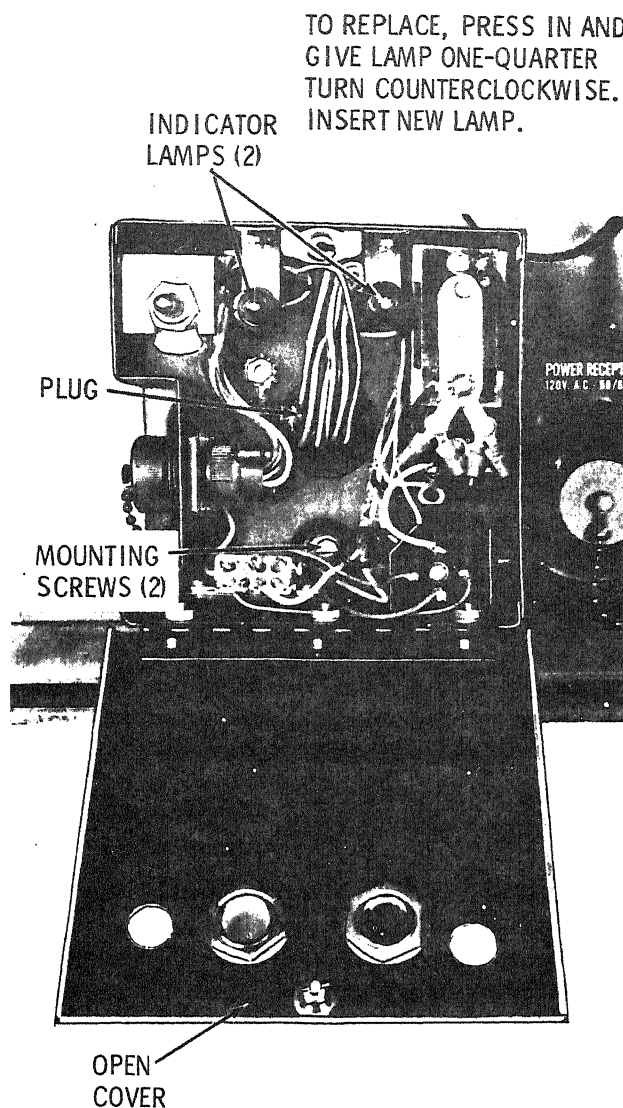
a. Removal and Disassembly.

(1) Remove the left and right hand side panels.

(2) Remove and disassemble the circulating air motor and fan as illustrated in figure 3-21.

b. Cleaning and Inspection.

(1) Wipe circulating air motor with a cloth dampened with an approved cleaning solvent; dry thoroughly.



TO REMOVE CONTROL BOX:

STEP 1. GIVE TWIST-LOCK MOUNTING SCREWS A QUARTER TURN COUNTERCLOCKWISE; REMOVE CONTROL BOX.

STEP 2. DISCONNECT PLUG FROM MATING RECEPTACLE ON HEATER.

TO REASSEMBLE, REVERSE REMOVAL PROCEDURE.

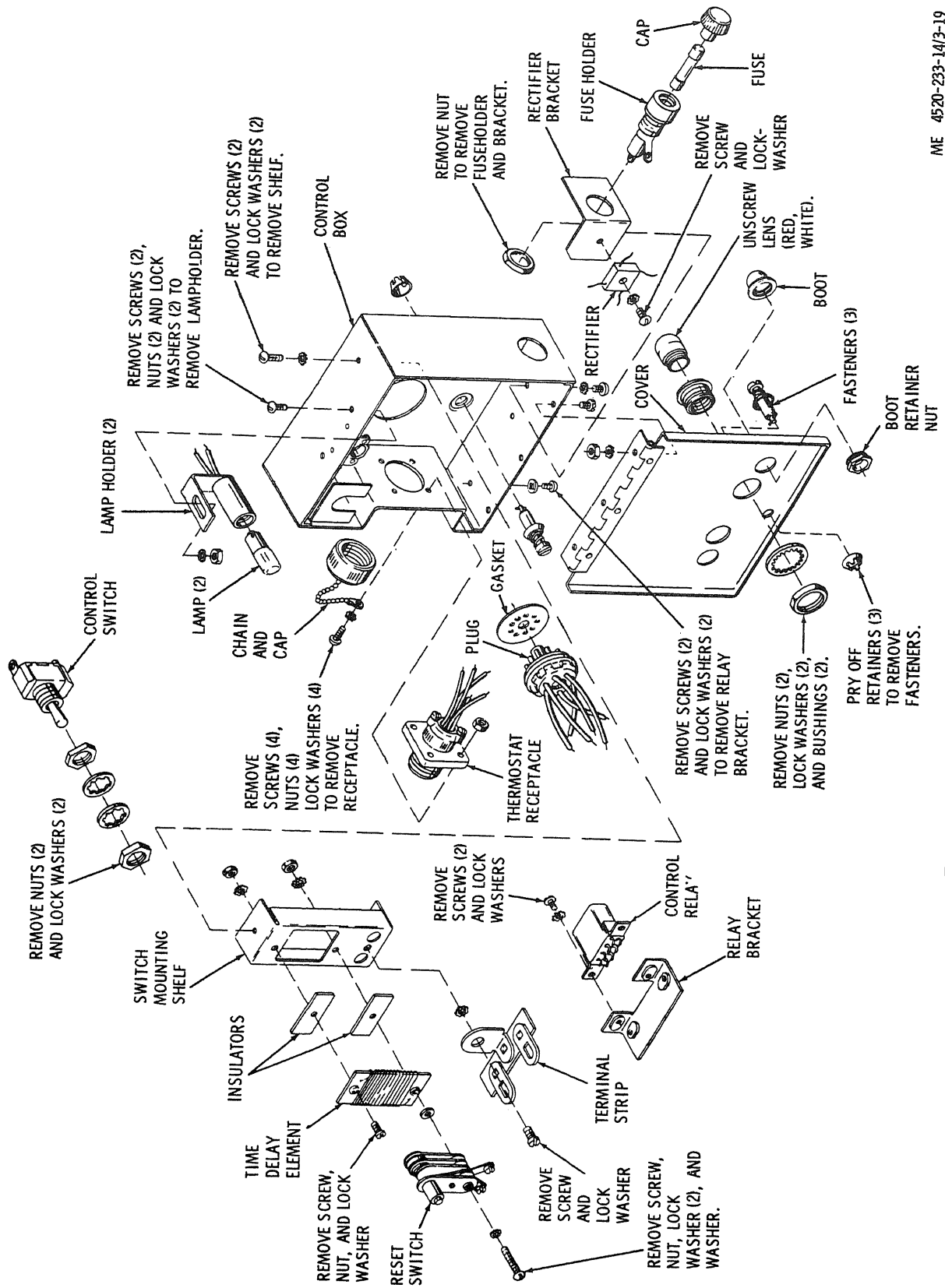
MEC 4520-233-14/3-18

Figure 3-18. Replacing indicator lamps and control box removal.

(2) Wipe rubber mounts with a dry cloth.

(3) Wash all metal parts in cleaning solvent; dry thoroughly.

(4) Inspect motor for defective operation or visible damage; replace if defective or damaged. Inspect motor leads for wear, deterioration, frayed insulation, or other damage; replace motor if leads are damaged beyond repair.



ME 4520-233-14/3-19

Figure 8-19. Control box, disassembly and reassembly.

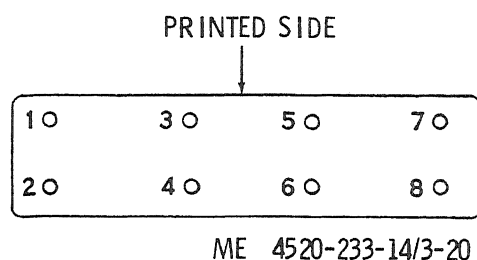


Figure 3-20. Control relay terminal identification.

(5) To test the operation of the motor, install the fan on the motor and mount the motor on a suitable bench stand. Connect the motor and an ac ammeter in series with a 115-volt, 50 or 60 cycle, single phase, alternating current source. With the motor operating under fan load, the current draw shall not exceed 1.2 amperes. Use a tachometer to check motor speed. It shall be approximately 1425 rpm when operating in a 50 cycle circuit or approximately 1725 when operating in a 60 cycle circuit. Replace the motor if the current draw is too high or if the speed is too low.

(6) Inspect rubber mounts for tears, rips, or other damage: remove if damaged, and carefully remove all adhesive debris. Cement new rubber mounts to band with adhesive per MIL-A-5092, Type 2.

(7) Inspect the axial fan for cracked, broken or dented blades, deformed or elongated bore or setscrew holes, or other damage. Replace if damaged.

(8) Inspect the ground leads for cracks, breaks, or damaged terminals: replace if damaged.

(9) Inspect all other parts for cracks, breaks, dents, deformation, damaged threads, or other damage: replace if damaged.

c. Reassembly and Installation.

(1) Reassemble and install the circulating air motor and fan as illustrated in figure 3-21.

(2) Install the left and right side panels.

3-27. Combustion Blower and Motor Assembly

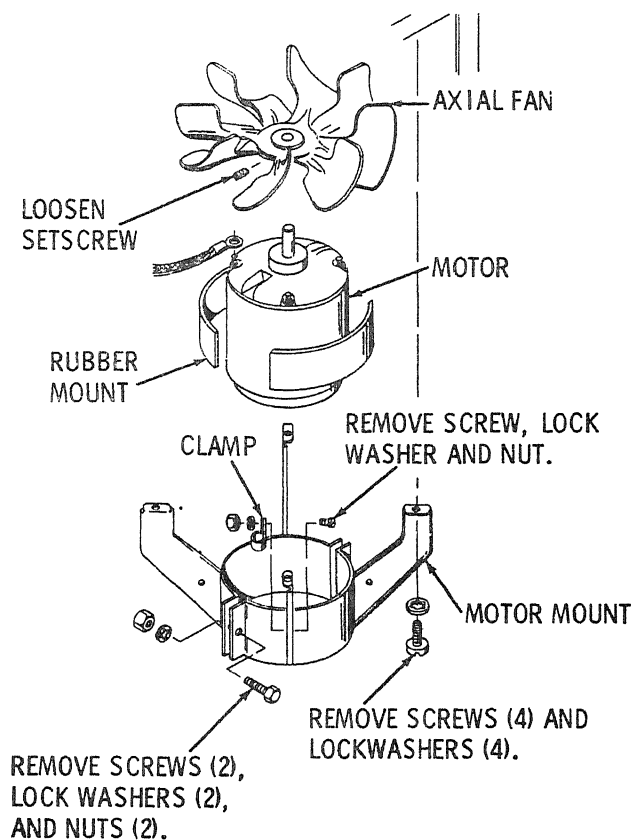
a. Removal.

(1) Open the front and right side access doors. Remove the right and left side panels.

(2) Remove the combustion blower and motor assembly as shown in figure 3-22.

b. Cleaning and Inspection.

(1) Clean the exterior of the combustion blower and motor assembly with a cloth dampened with an approved cleaning solvent; dry



ME 4520-233-14/3-21

Figure 3-21. Circulating air motor and fan, removal, disassembly, resassembly, and installation.

thoroughly. Take care to prevent solvent from entering the interior of the assembly.

(2) Inspect the exterior of the combustion blower and motor assembly for cracks, signs of overheating, and other visible damage. If the unit is visibly damaged, or if it fails to operate in the heater, replace the combustion blower and motor assembly as a unit. Refer the defective combustion blower and motor to direct support maintenance.

c. Installation.

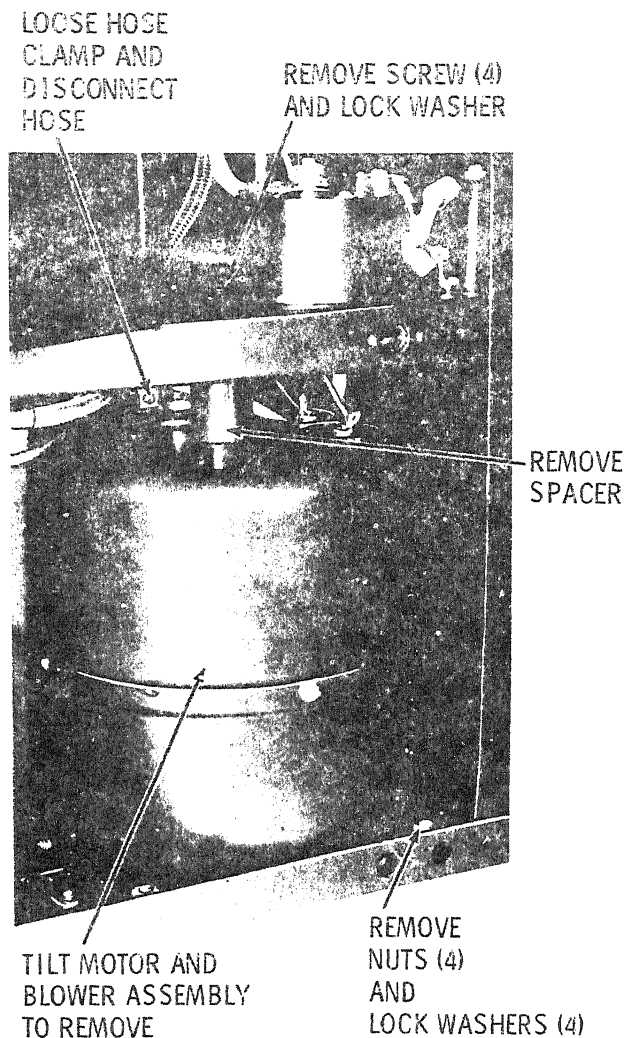
(1) Install the combustion blower and motor as shown in figure 3-22.

(2) Install the right and left side panels. Close the front and right side access doors.

3-28. Room Thermostat

a. Removal. Remove the cover from the room thermostat (fig. 3-23) and disconnect the electrical leads. Remove the hardware that secures the room thermostat to the wall and remove the thermostat.

NOTE: DISCONNECT ELECTRICAL LEADS
AS NECESSARY



MEC 4520-233-14/3-22

Figure 3-22. Combustion blower and motor, removal and installation.

b. Cleaning and Inspection.

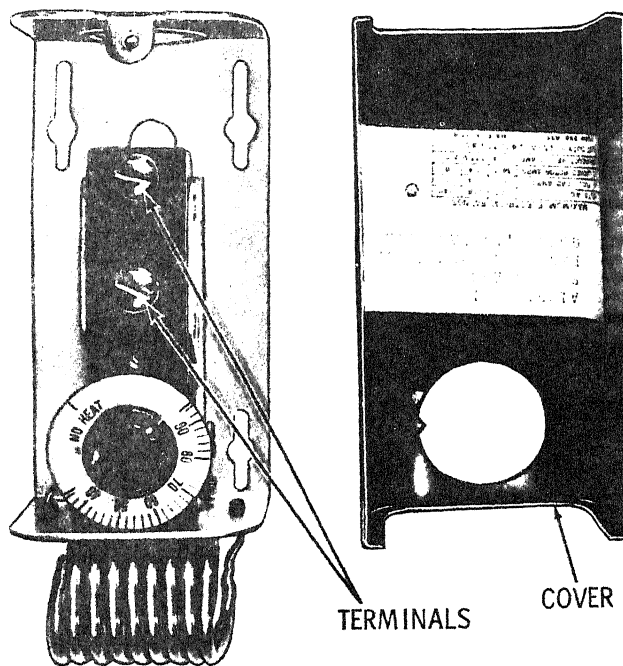
(1) Clean the thermostat and cover with a cloth dampened with an approved cleaning solvent; dry thoroughly. Do not let solvent seep into internal parts of the thermostat.

(2) Inspect the thermostat for cracks, distortion, restricted movement of the adjuster, and other damage.

(3) Check the electrical characteristics of the thermostat. Continuity must exist through the thermostat when the ambient temperature is lower than the set temperature of the thermostat. Continuity must not exist when the ambient temperature is higher than the set temperature of the thermostat.

(4) Replace the thermostat if it is visibly damaged or if the operation is faulty.

c. Installation. Refer to paragraph 3-28a for installation of the room thermostat.



MEC 4520-233-14/3-23

Figure 3-23. Room thermostat, cover removed.

Section VIII. LOUVERS, PANELS, AND DOORS

3-29. General

a. The heater case consists of a framework, with a shelf and bulkhead, forming four basic compartments. Access doors provide easy entry to the compartments that have components to be serviced or maintained frequently. The left and right side panels provide access to the lower rear

compartment at each side. The upper rear compartment contains the heat exchanger; access to it is through the rear panel. All panels except the rear upper panel are fastened by turn-lock fasteners. The doors are also held in the closed position by means of turn-lock fasteners.

b. Both left and right side panels have air inlet side cover panels, secured by screws, that cover movable louvers. The louvers are controlled by a louver operating handle at the front of the heater. When the handle is moved in, the left louver closes and the right louver opens. The heater should be positioned so that one air inlet panel is uncovered and the handle moved so that the louver panel is open. Additional air flow can be obtained by removing the heater bottom plate if the bottom of the heater is not obstructed. If both sides of the heater are unobstructed, both louver panels can be opened by placing the handle in a midposition. This allows the circulating air fan to force a supply of air through the heat exchanger and out of the discharge opening, heating the space.

3-30. Panels and Doors

a. *Removal and Disassembly.* Remove and disassemble the heater panels and doors as illustrated in figures 3-24 and 3-25.

b. *Cleaning and Inspection.*

(1) Clean all parts with a cloth dampened with an approved cleaning solvent; dry thoroughly.

(2) Inspect all parts for cracks, distortion, damaged fasteners, damaged threads, severe

dents, and other damage. Straighten dented panels. Touch up scratched and damaged paint. Replace all parts damaged beyond repair.

(3) If the heater case is damaged and requires repair, refer it to direct support maintenance.

c. *Reassembly and Installation.* Reassemble the panels and doors as illustrated in figures 3-24 and 3-25.

3-31. Louver Mechanism

a. *Removal and Disassembly.*

(1) Remove left and right side panels.

(2) Disassemble the louver mechanism as illustrated in figure 3-25.

b. *Cleaning and Inspection.*

(1) Clean all parts with an approved cleaning solvent; dry thoroughly.

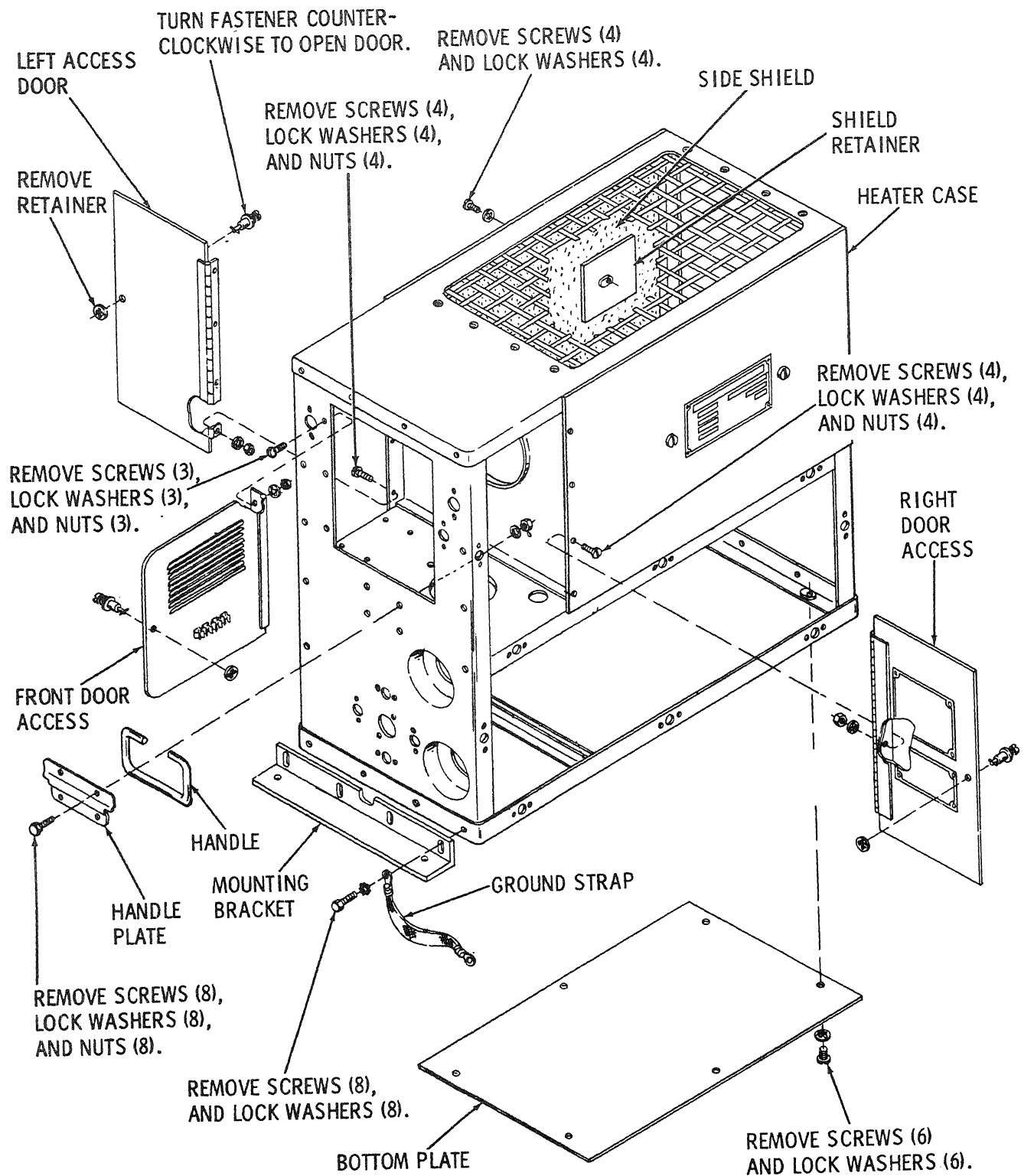
(2) Inspect all springs for distortion, compression, and other damage; replace damaged springs.

(3) Inspect all other parts for cracks, dents, bends, and other damage; replace damaged parts.

c. *Reassembly and Installation.*

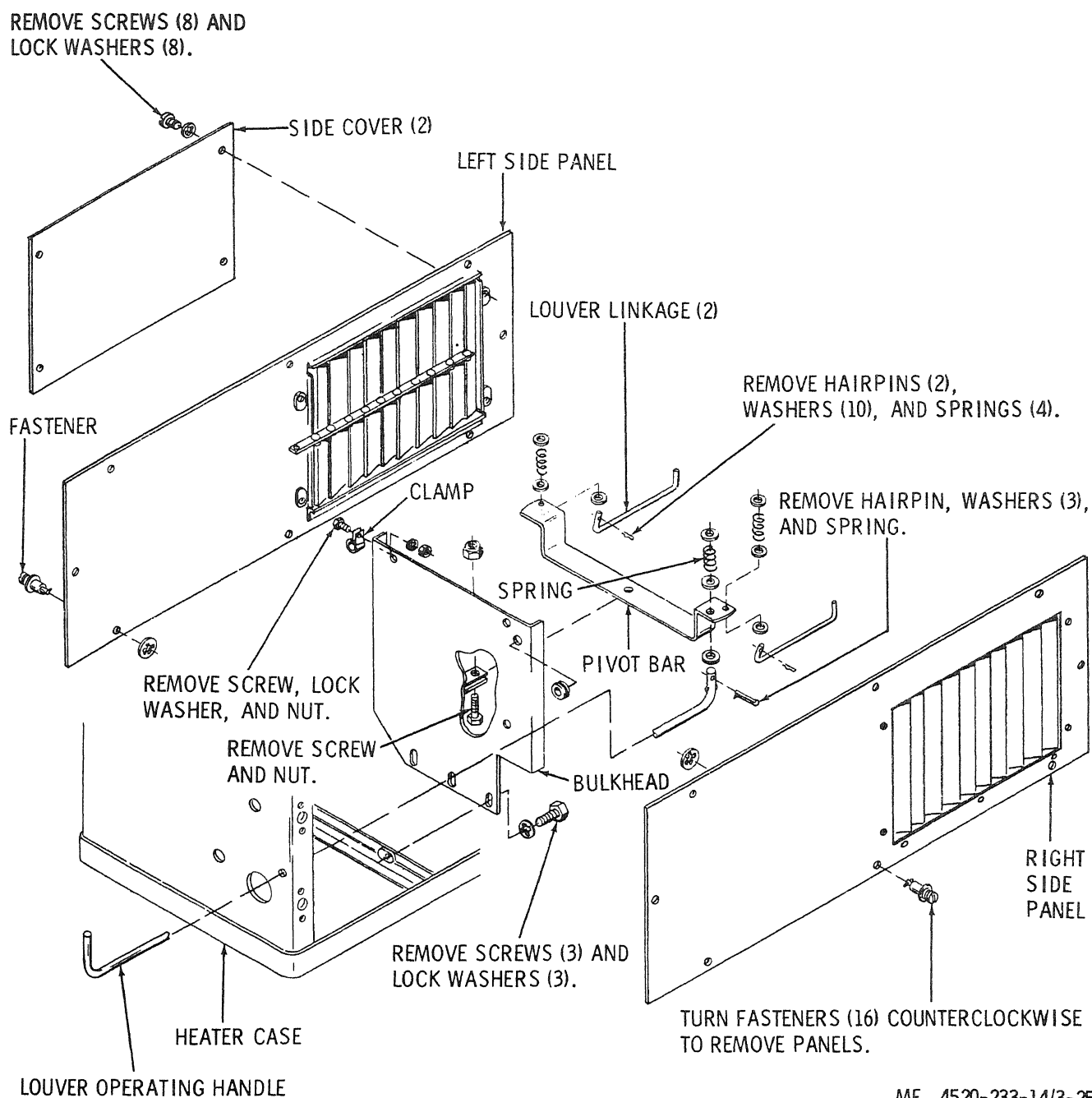
(1) Reassemble the louver mechanism as illustrated in figure 3-25.

(2) Install the left and right side panels.



ME 4520-233-14/3-24

Figure 3-24. Heater doors, removal and installation.



ME 4520-233-14/3-25

Figure 3-25. Heater panels and louver mechanism, removal and installation.

Section IX. BURNER HOUSING

3-32. General

a. Air from the combustion air system and fuel metered by the carburetor join in the mixer in the burner housing. The air with the atomized fuel entrained then flows past the igniter plug. The igniter plug, which arcs constantly while the

control system calls for heat, ignites the fuel air mixture which then burns with an intense flame.

b. The combustion air forces the heat through the internal passages of the heat exchanger where most of the heat is transferred to the metal walls of the heat exchanger. The combustion air is then discharged through the exhaust port.

3-33. Burner Housing

a. Removal.

- (1) Open front, left, and right access doors.
- (2) Disconnect air hose from burner housing.
- (3) Remove igniter plug (para 3-18) and carburetor (para 3-15).
- (4) Remove the burner housing and gasket as illustrated in figure 3-6.

b. Cleaning and Inspection.

- (1) Clean burner housing thoroughly with an approved cleaning solvent; dry thoroughly.

(3) Inspect the burner housing for cracks, dents, holes, corrosion, and other damage; replace a damaged burner housing.

c. Installation.

- (1) Install the burner housing as illustrated in figure 3-6.
- (2) Install the igniter plug (para 3-18) and carburetor (para 3-15).
- (3) Connect air hose from the combustion blower to the air inlet on the burner housing. Make sure hose clamp is tight.
- (4) Close front, left, and right access doors.

CHAPTER 4

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

4-1. General

This section provides instructions for preparation for shipment and limited storage of the space heater, Model UH-68D.

4-2. Preparation for Shipment

- a. Perform all preventive maintenance and services (table 3-1) to insure that the heater will be in proper operating condition after shipment.
- b. Drain fuel from fuel lines and empty fuel from fuel filter bowl, carburetor float bowl, and fuel pump chamber.
- c. Repaint or touch up chipped or peeled paint as required to protect exposed metal surfaces.

d. Seal openings into the heater with water-proof tape.

e. Pack the heater in a carton which will protect it from the environmental and handling conditions encountered during shipment.

f. Mark the packed heater to conform with MIL-STD-129.

4-3. Limited Storage

a. Prepare the heater for storage in the same manner as preparing it for shipment (para 4-2a through f).

b. Inspect heater periodically while in storage to insure that it is adequately protected and that equipment deterioration is not taking place.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

4-4. General

This section provides instructions for destroying the space heater to prevent enemy use when it is in danger of imminent capture. Several methods of demolition are provided. The operator must familiarize himself with all methods of destruction to enable him to accomplish the demolition without reference to this or any other manual.

Caution: Demolish the space heater only upon order of the proper authority.

4-5. Demolition

Use any of the following methods that will fix the tactical situation.

a. *Smash.* Smash the carburetor, ignition transformer, blower motor, fuel pump, burner head,

heat exchanger, and electrical controls. Use sledges, crowbars, axes, pickaxes, hammers, or heavy tools.

b. *Burn.* Pack the inside of the housing loosely with rags or paper saturated with gasoline or fuel oil, and ignite. Alternate methods of destruction by burning can be accomplished by use of flame throwers or incendiary grenades.

c. *Explode.* If destruction by explosives is necessary, use a fragmentation or concussion grenade or a half-pound block of TNT inserted in the inside of the housing.

d. *Disposal.* Remove parts such as the carburetor, electrical controls and relays, ignition power supply, and blower motor and bury them in slit trenches or foxholes, or hide them in dense vegetation or streams.

CHAPTER 5

DIRECT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

5-1. Scope

These instructions are published for the use of direct and general support maintenance personnel maintaining the space heater, Model UH-68D. They provide information on the maintenance of the equipment, which is beyond the scope of tools, equipment, personnel, or supplies normally available to the using organizations.

5-2. Record and Report Forms

For record and report forms applicable to direct and general support maintenance, refer to TM 38-750.

Note. Applicable forms, excluding Standard Form 46 (United States Government Motor Vehicles Operator's Identification Card) which is carried by the operator, shall be kept in a canvas bag.

Section II. DESCRIPTION AND TABULATED DATA

5-3. Description

For a complete description of the space heater, Model UH-68D, see paragraph 1-3.

5-4. Tabulated Data

a. General. This paragraph contains all the overhaul data pertinent to direct and general support maintenance personnel.

b. Combustion Motor and Blower Assembly.

Manufacturer	Lamb Electric Company
Type	AC motor with integral fan
Part No.	I.S. 14965
Horsepower	3/8
Speed	8000 rpm
Voltage rating	115 volts
Phase	single phase
Duty cycle	Continuous
Rotation	CCW facing fan end

Section III. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

5-5. Special Tools and Equipment

No special tools or equipment are required by direct and general support maintenance personnel for performing maintenance on the space heater, Model UH-68D.

5-6. Maintenance Repair Parts

Direct and general support maintenance repair

parts are listed in TM 5-4520-233-24P (when printed).

5-7. Specially Designed Tools and Equipment

No specially designed tools or equipment are required by direct and general support maintenance personnel for performing maintenance on the space heater, Model UH-68D.

Section IV. TROUBLESHOOTING

5-8. General

This section provides information useful in diagnosing and correcting unsatisfactory operation of failure of the space heater, Model UH-68D,

and its components. Malfunctions which may occur are listed in table 5-1. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause.

Warning: The space heater contains dangerous voltages which can cause severe electrical shock or death. Be extremely careful when making voltage measurements or other checks with

the heater connected to the power source during troubleshooting. Always remove power plug before making any continuity tests.

Table 5-1. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Combustion blower and motor assembly fails to run	Worn brushes Defective stator Defective motor protector thermo Armature defective	Replace brushes (para 6-2). Replace motor (para 3-27). Replace motor (para 3-27). Replace motor (para 3-27).
2. Combustion blower and motor assembly runs but is noisy	Bearings defective Rotating fan rubbing against end bracket, stationary fan, or shell	Replace bearings (para 6-2). Disassemble and correct cause of rubbing (para 6-2).
3. Room air contaminated with combustion fumes	Heat exchanger cracked or rusted through Exhaust pipe leakage	Replace heat exchanger (para 6-4). Tighten or replace if defective.
4. Burner assembly fails to operate in the sequence described in paragraph 3-21d.	Electrical leads broken or damaged	Fabricate new electrical leads as required (para 6-8).

Section V. RADIO INTERFERENCE SUPPRESSION

5-9. General

Refer to TM 11-483 for definitions, purposes, and source and methods used to obtain proper radio suppression.

5-10. Testing of Radio Interference Suppression Components

Test the capacitors for leaks and shorts on a capacitor tester; replace defective capacitors. If test equipment is not available and interference is indicated, isolate the cause of interference by the trial-and-error method of replacing each capacitor in turn until the cause of interference is located and eliminated.

5-11. Interference Suppression Components

a. Primary Suppression Components. The primary suppression components are those whose primary function is to suppress radio interference. The components replaceable at direct support maintenance are described and located in figure 5-1.

b. Secondary Suppression Components. These components have radio interference suppression functions which are incidental or secondary to their primary function.

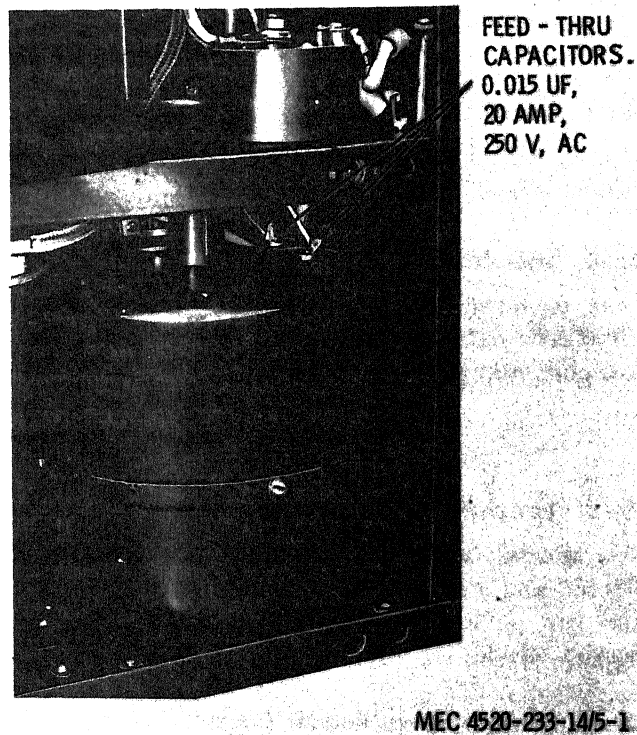


Figure 5-1. Radio interference suppression components.

5-12. Replacement of Suppression Components

Refer to paragraph 6-2 and replace the radio interference suppression capacitors installed in the combustion blower assembly.

CHAPTER 6

REPAIR INSTRUCTIONS

Section I. COMBUSTION BLOWER AND MOTOR ASSEMBLY

6-1. General

a. The combustion blower and motor assembly consists of an ac motor assembly and a blower system encased in a two-part external housing.

b. The series wound motor operates at approximately 12,500 rpm on a continuous duty basis. Capacitors are provided in the ac input circuit to suppress radio-frequency interference that could disrupt radio communications.

c. The blower is a centrifugal-type unit consisting of two rotating fans mounted on the motor armature shaft. The fans are enclosed by the fan shell, stationary fan, and fan end bracket. The air is drawn into the outer housing and into the hole in the fan shell at the bottom of the fan assembly. It then enters the fans and is routed past the motor windings to provide cooling and is then ejected through a tube which is part of the motor housing. From the tube it is forced through the air hose into the burner housing.

6-2. Combustion Blower and Motor Assembly

a. *Removal.* Remove the combustion blower and motor assembly as directed in paragraph 3-27.

b. *Disassembly.* Disassemble the combustion blower and motor assembly as illustrated in figure 6-1.

(1) Complete disassembly of the blower and motor assembly is not necessary to replace the radio interference suppression capacitors. Remove the top housing (3) and the motor housing (12) and remove the nuts (13) and lockwashers (15) that secure the capacitors (14) to the motor housing.

(2) Complete disassembly of the blower motor assembly is not necessary to replace the motor brushes. To replace motor brushes, remove the top housing (3) and motor housing (12) and replace brushes as shown in figure 6-2. Motor brushes must be replaced if they are cracked, chipped, oil-saturated, or worn to less than 7/8 inch long.

(3) When completely disassembling the unit, match-mark the commutator end bracket (20), field assembly (39), and fan end bracket (30) to assure that the parts will be reassembled in the same positions from which they were removed.

c. *Cleaning and Inspection.*

(1) Wipe all electrical parts with a clean, dry cloth. Remove any greasy or gummy deposits with a cloth dampened lightly with an approved cleaning solvent; dry thoroughly. Take care not to saturate electrical parts with solvent.

(2) Clean all metallic parts with an approved cleaning solvent; dry thoroughly.

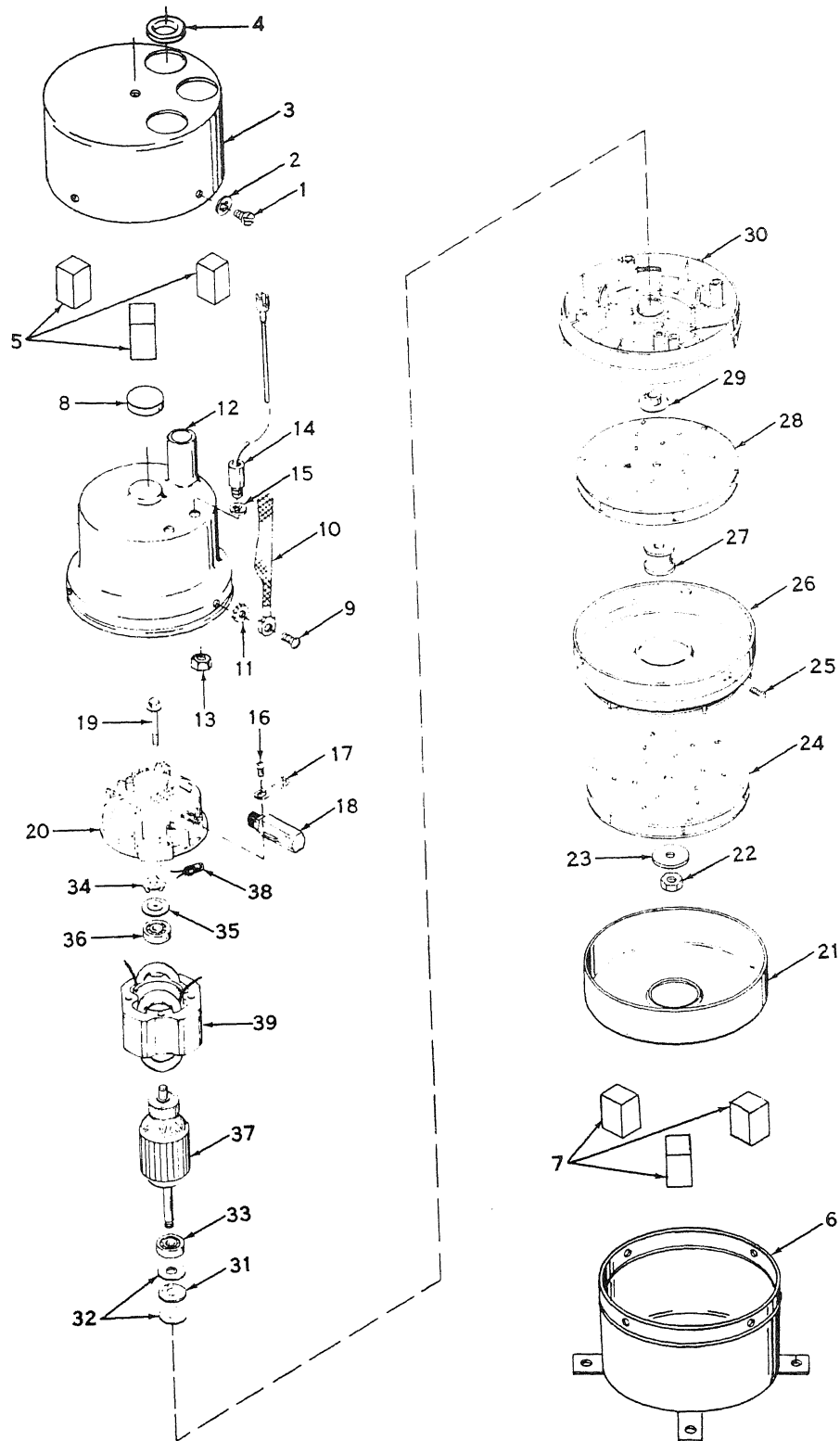
(3) Inspect the motor armature for cracks, damaged windings, and damaged bearing seats. Check the motor commutator for out-of-roundness, burned commutator bars, pitting and severe discoloration. (A slight darkening of the commutator bars is desirable condition indicating good commutation.) If the commutator is slightly scored or pitted, it can be resurfaced with fine crocus cloth. Be sure all abrasives are removed from between commutator bars after resurfacing. Replace the motor armature damaged beyond the point at which it can be corrected with the slight repair indicated above.

(4) Inspect the field assembly (39) for visual damage, signs of overheating or burning or damaged windings. Check the field coil for continuity and grounds. Replace a damaged field assembly.

(5) Inspect the rotating fans (24 and 28) for cracks, deformation, wear due to rubbing, and other damage; replace damaged rotating fans.

(6) Check the motor protector (38) for visible damage. Check the operation of the motor protector by heating it in an oven and checking continuity. The protector circuit must open at 249°F and close at 183°F.

(7) Inspect the support pads (5, 7, and 8) for cracks, deterioration, and flat spots. If dam-



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1. Machine screw, No. 10-24 x 3/16 in. (4 rqr)
2. Lockwasher, No. 10 (4 rqr)
3. Top housing

4. Grommet
5. Pads
6. Bottom housing

Figure 6-1. Combustion blower and motor assembly, disassembly and reassembly.

- | | |
|--|---|
| 7. Pads (3 rqr) | 23. Washer |
| 8. Pad | 24. Rotating fan |
| 9. Machine screw, No. 8-32 x 1/4 in. (3 rqr) | 25. Machine screw, No. 6-32 x 3/4 in. (3 rqr) |
| 10. Ground strap | 26. Stationary fan |
| 11. Lockwasher, No. 8 (3 rqr) | 27. Spacer |
| 12. Motor housing | 28. Rotating fan |
| 13. Nut, 5/16-18 (2 rqr) | 29. Spacer |
| 14. Capacitor (2 rqr) | 30. Fan end bracket |
| 15. Lockwasher, 5/16 in. (2 rqr) | 31. Felt washer |
| 16. Machine screw, No. 8-32 x 5/16 in. (4 rqr) | 32. Washer |
| 17. Brush clamp (2 rqr) | 33. Ball bearing |
| 18. Electrical contact brush (2 rqr) | 34. Load spring |
| 19. Screw and washer assembly, No. 10-24 x 2 1/2 in. (2 rqr) | 35. Disc |
| 20. Commutator end bracket | 36. Ball bearing |
| 21. Fan shell | 37. Armature |
| 22. Nut, 5/16-24 | 38. Motor protector |
| | 39. Field assembly |

Figure 6-1—Continued.

aged, remove the pads and all the adhesive residue. Cement new pads into place with adhesive conforming to MIL-A-5092, Type 2.

(8) Inspect all other parts for cracks, dents, damaged threads, and other damage; replace damaged parts.

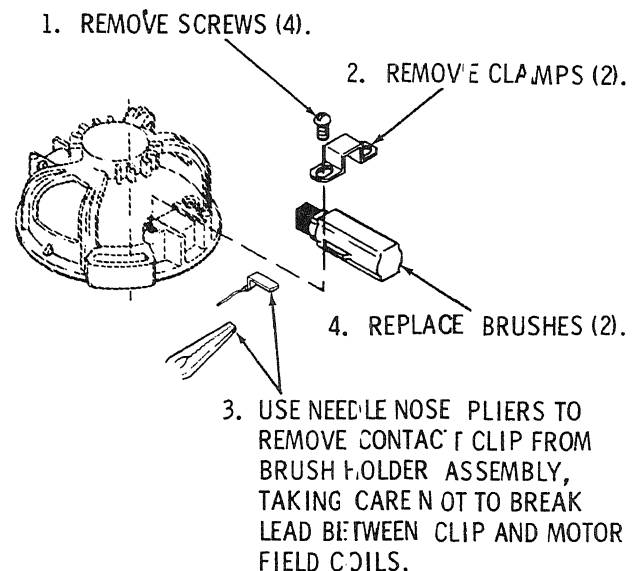
d. Reassembly.

(1) Reassemble the combustion blower and motor assembly as shown in figure 6-1.

(2) Be sure to align the match marks made on the commutator end bracket (20), field assembly (39), and fan end bracket (30).

(3) After the motor and fan is assembled, but before installing the motor housing (12), check that the motor armature rotates freely. If it does not, slightly adjust the positions of the parts so that it does rotate freely without any scraping or binding of the fans against their housings.

e. Installation. Install the combustion blower and motor assembly as directed in paragraph 3-27.



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Figure 6-2. Replacing combustion motor brushes.

Section II. HEAT EXCHANGER

6-3. General

a. The heat exchanger is mounted in the upper rear of the heater housing. It consists of steel stampings welded together to form a maze of passages through which the hot gases from the burning fuel are forced to pass. The heat from the combustion gases is transferred to the walls of the heat exchanger so that most of the heat is removed before the gases are ejected through the exhaust pipe at the rear of the heat exchanger.

b. The heat exchanger is designed to present large exterior areas around which the circulating fresh air is forced by the circulating air fan. As

the air passes the heated walls of the heat exchanger, it removes heat from the heat exchanger and circulates it through the enclosure being heated.

c. A threaded port is provided at the left front of the heat exchanger to receive the connector into which the flame switch thermocouple is installed. The heat of combustion is directed around the thermocouple to cause the thermocouple to generate an electric current, which actuates the flame switch relay.

d. Insulation is provided on the cover around the heat exchanger to reduce the heat transfer

through the sides of the heater case. The support straps hold the front and rear shield to the rear cover, while side shields are held by nut plates, screws, and lockwashers.

6-4. Heat Exchanger

a. Removal.

(1) Open the front, left, and right access doors.

(2) Remove the burner housing (para 3-33).

(3) Remove the thermocouple (para 3-22).

(4) Remove the circulating air motor and fan (para 3-26).

(5) Remove the heat exchanger as illustrated in figure 6-3. Lower the rear end of the heat exchanger slightly to remove it through the rear panel opening.

(6) The rear plate shield and the side shields (fig. 3-24) do not have to be removed unless they are damaged, saturated with oil, or otherwise faulty.

b. Cleaning and Inspection.

(1) Clean all metallic parts with an approved cleaning solvent; dry thoroughly.

(2) Wipe the insulating shields with a dry cloth.

(3) Inspect the heat exchanger for cracks, rusted out or burned out areas, severe dents, damaged threads, and other damage; replace a damaged heat exchanger.

(4) Inspect all other parts for cracks, distortion, damaged threads, and other damage; replace damaged parts.

Warning: Do not reinstall a heat exchanger which is cracked or has holes in it. This will allow combustion gases to contaminate the circulating air. Since the combustion gases contain carbon monoxide, a deadly poison, this could result in illness or death of room occupants.

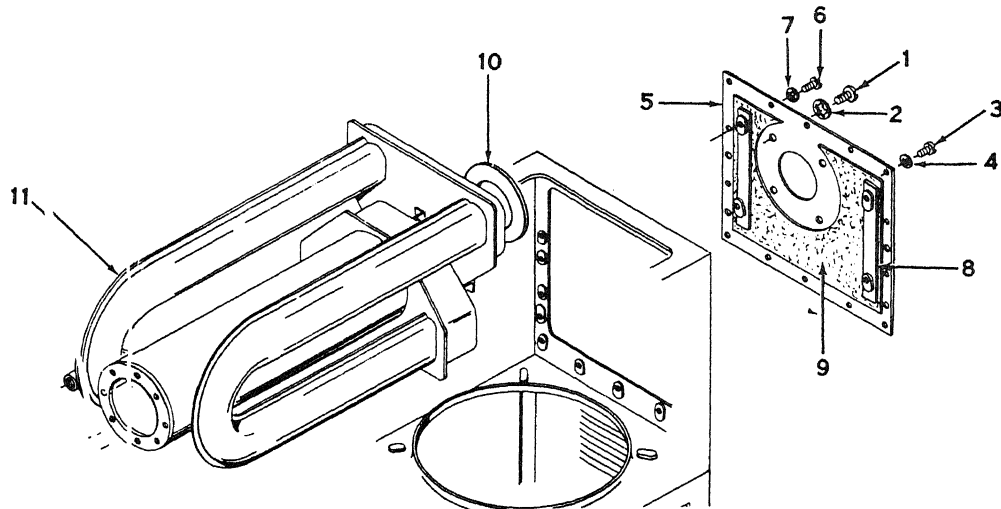
c. Installation.

(1) Install the heat exchanger as illustrated in figure 6-3.

(2) Install the thermocouple (para 3-22).

(3) Install the burner housing (para 3-33).

(4) Close the front and side access doors.



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1. Machine screw, 1/4-20 x 3/8 in. (4 rqr)
2. Lockwasher, 1/4 in.
3. Machine screw, 1/4-20 x 3/8 in. (8 rqr)
4. Lockwasher, 1/4 in.
5. Rear cover
6. Machine screw, No. 10-24 x 3/8 in. (4 rqr)

7. Lockwasher, No. 10
8. Support strap
9. Rear plate shield
10. Gasket
11. Heat exchanger

Figure 6-3. Heat exchanger, removal and installation.

Section III. HEATER CASE REPAIR

6-5. General

The heater case consists of a welded sheet metal case having divider panel as necessary to mount

components and separate the compartments of the case. The case has integral weld nuts and weld studs for the mounting of components and

panels. It also has riveted sockets for the twist-lock fasteners used to hold the side panels and the control box, as well as to secure the access doors closed. It has a coarse-mesh screen welded into the top opening to act as a guard for the heat exchanger.

6-6. Heater Case Repair

a. Disassembly. If extensive welding and straightening of the heater case is required, disassemble it to the extent required as follows:

(1) Remove the fuel filter (para 3-13), fuel pump (para 3-14), carburetor (para 3-15), and fuel lines (para 3-16).

(2) Remove the igniter plug (para 3-18), ignition transformer (para 3-19), overheat thermostat (para 3-20), fuel pump power supply (para 3-21), flame switch and thermocouple (para 3-22), pump receptacle and power receptacle (para 3-23) and terminal strip (para 3-24).

(3) Remove the control box (para 3-25), control box receptacle and wiring harness (para 6-8), circulating air fan (para 3-26), and combustion blower and motor assembly (para 3-27).

(4) Remove the panels and doors (para 3-30) and louver mechanism (para 3-31).

(5) Remove the burner housing (para 3-33) and heat exchanger (para 6-4).

b. Cleaning, Inspection, and Repair.

(1) Clean the interior and exterior of the heater case with a cloth dampened with an approved cleaning solvent, dry thoroughly.

(2) Inspect the heater case for cracks, broken weldments, loose or missing weld studs and weld nuts and loose guard screen. Reweld where necessary, using electric arc welding methods.

(3) Straighten any dents in the heater case and correct any misalignment of the frame.

(4) Check for rust and corrosion. Clean any affected areas with sandpaper until all corrosion is removed and the underlying metal is bright. Repaint as necessary.

(5) Check for damaged, loose, or missing twist-lock fastener sockets. If necessary, install new sockets with rivets.

(6) Replace the heater if case cannot be repaired.

c. Reassembly. Reassembly is the reverse of the disassembly procedure described in subparagraph *a*, above.

Section IV. ELECTRICAL WIRING REPAIR

6-7. General

Color-coded wire is used to connect the electrical components of the space heater. Two wiring harnesses are used. One of the wiring harnesses distributes electrical power to the components within the heater case. The second wiring harness distributes electrical power to the components in the control box. The control box plug mates with the control box receptacle which is secured to the heater case behind the control box.

6-8. Electrical Wiring Harnesses and Leads

a. Removal.

(1) Remove the control box (para 3-25). If the control box wiring harness is damaged, unsolder and disconnect electrical leads and remove the wiring harness and plug from the control box.

(2) If the heater case wiring harness is damaged, unsolder and disconnect the electrical leads from the components and remove the control box receptacle from the heater case as shown in figure 6-4.

(3) Remove any other interconnecting wires if they are damaged.

b. Cleaning and Inspection.

(1) Clean the wiring harnesses with a clean, dry cloth. Remove greasy and gummy deposits with a cloth dampened with an approved cleaning solvent. Take care not to saturate the electrical leads. Clean all terminals with sandpaper so that they are bright to assure good electrical contact.

(2) Inspect the wiring harness for broken leads, damaged or missing terminals, damaged or deteriorated insulation, burning, and other damage. Replace missing terminals. Individual leads can be replaced if necessary. Refer to the harness layouts in figures 6-5 and 6-6.

(3) If the wiring harnesses are severely damaged, replace the harnesses completely.

c. Installation. Installation is the reverse of the removal procedure described in subparagraph *a*, above. Install the control box receptacle on the heater case as shown in figure 6-4.

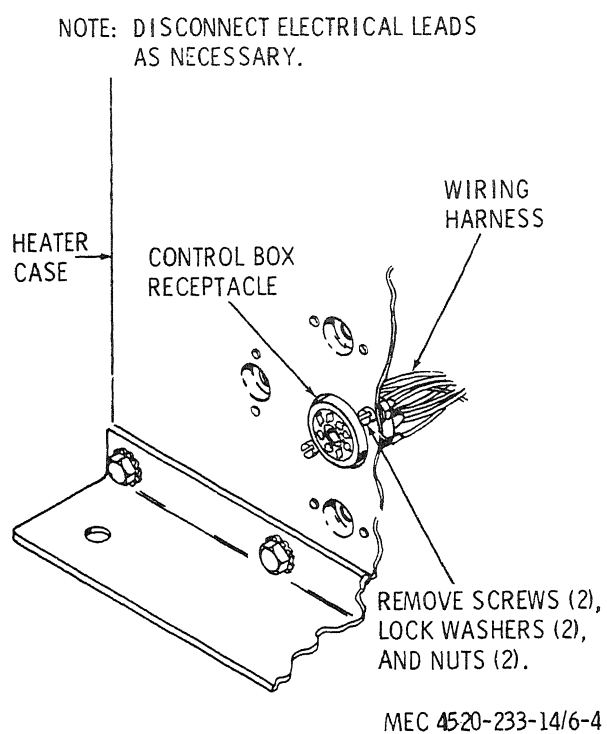
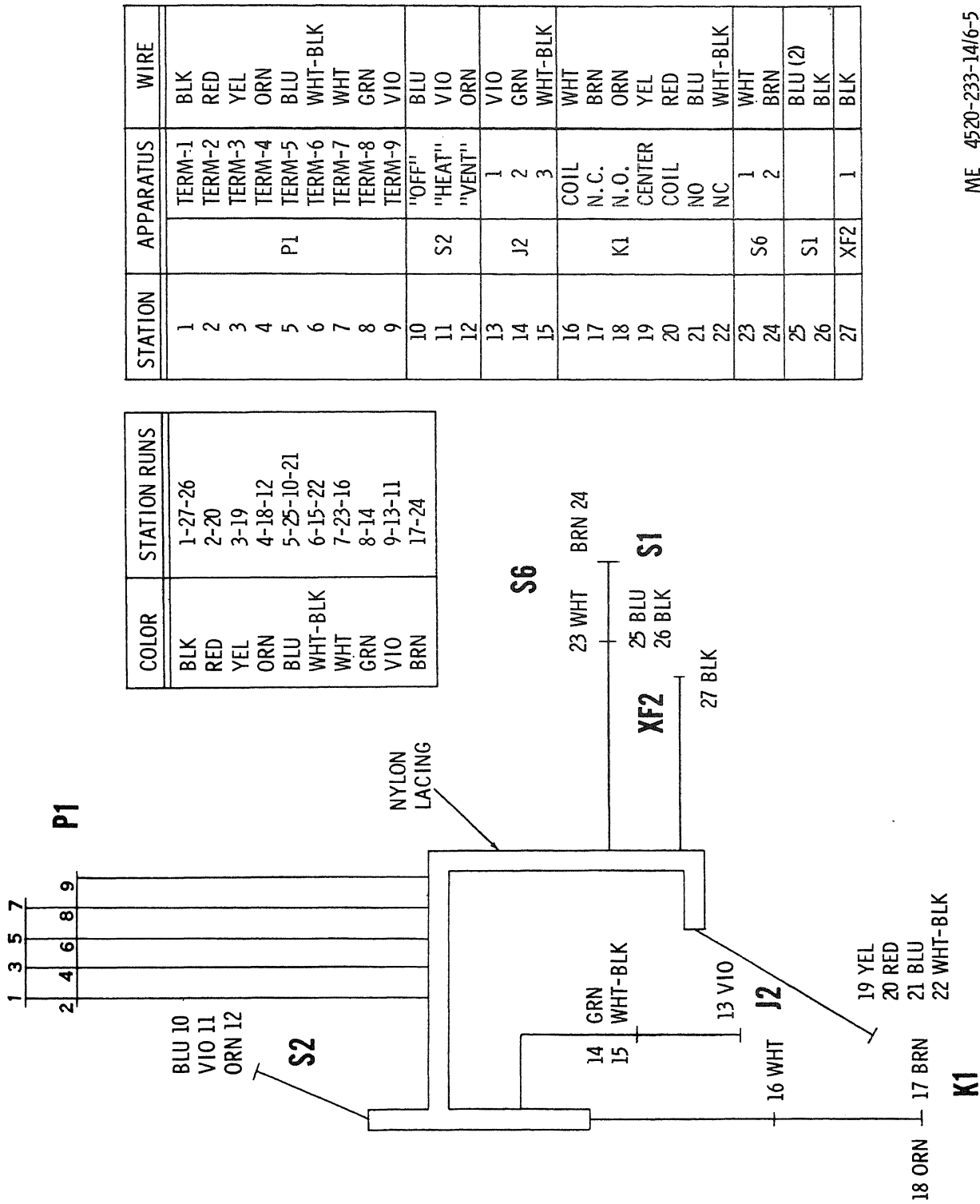


Figure 6-4. Removal and installation of control box jack or heater case.



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Figure 6-5. Control box wiring harness layout.

COLOR	STATION RUNS
BLK	1-2 8-9
RED	1-4
YEL	5-1-6
ORN	1-7
BLU	1-4 3-10
WHT-BLK	1-3
WHT	1-3-5 2-3-6-7
GRN	1-2
VIO	1-8

STATION	APPARATUS	WIRE
1	J3	TERM-1 BLK
		TERM-2 RED
		TERM-3 YEL
		TERM-4 ORN
		TERM-5 BLU
		TERM-6 WHT-BLK
		TERM-7 WHT
		TERM-8 GRN
		TERM-9 VIO
2	J1	TERM-1 BLK
		TERM-2 WHT
		TERM-3 GRN
3	TB1	TERM-1 WHT
		TERM-2 WHT
		TERM-3 WHT
		TERM-4 WHT
		TERM-5 WHT-BLK
		TERM-9 BLU
4	S3	TERM-1 BLU
		TERM-2 RED
5	B2	WHT
6	T1	YEL
7	B1	WHT
8	S7	ORN
9	TB1	TERM-1 VIO
		TERM-2 BLK
10	CR1	TERM-8 BLK
		BLU

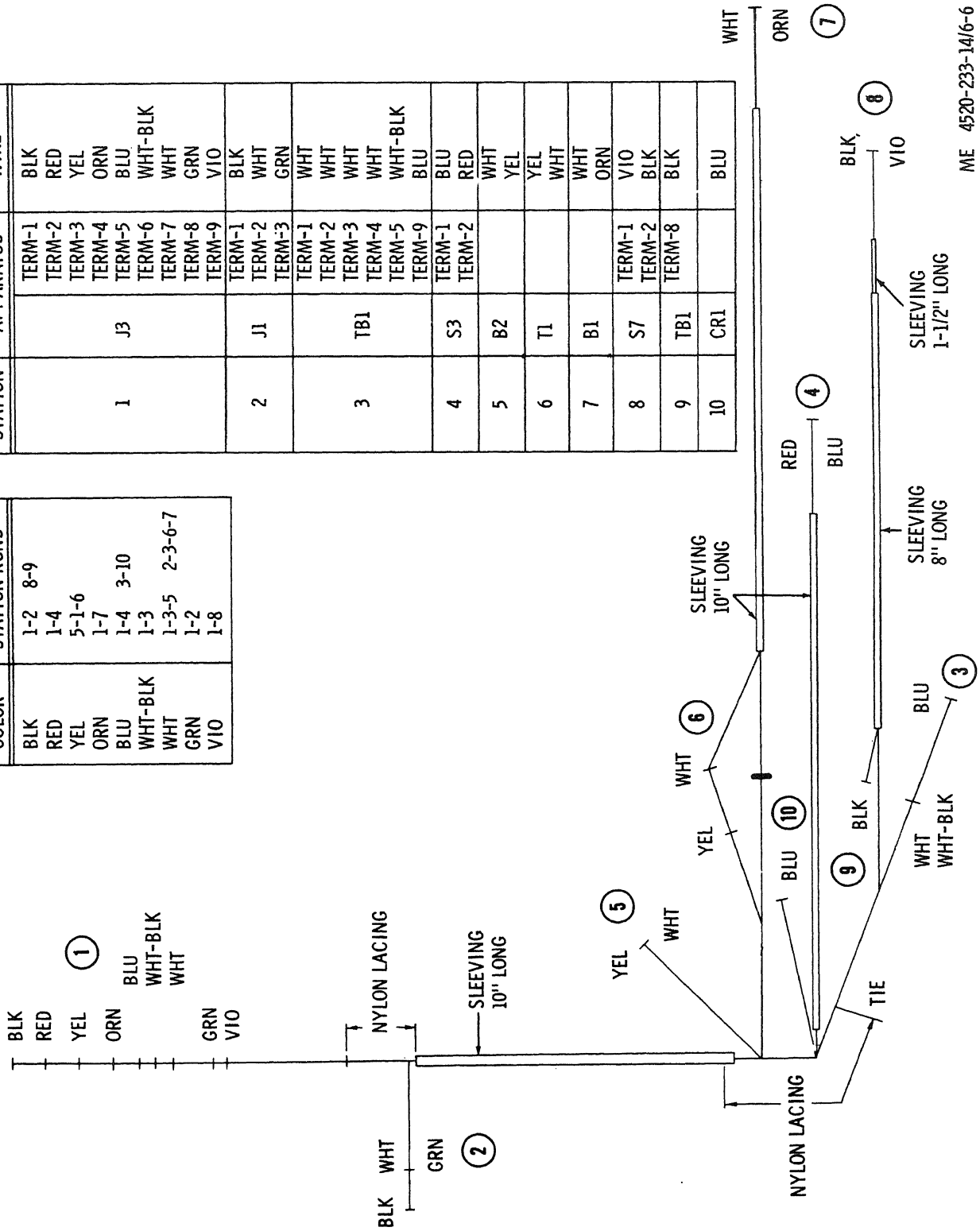


Figure 6-6. Heater case wiring harness layout.

APPENDIX A

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10 Hand Portable Fire Extinguishers Approved for Army Users.

A-2. Lubrication

C9100IL Fuels, Lubricants, Oils and Waxes.

A-3. Cleaning

TM 38-230-1 Preservation, Packaging and Packing of Military Equipment.
C6800IL Chemical and Chemical Products.

A-4. Painting

TM 9-213 Painting Instructions for Field Use.

A-5. Radio Suppression

TM 11-483 Radio Interference Suppression.

A-6. Maintenance

TM 38-750 Army Equipment Procedures.
TM 5-4520-233-24P Organizational, Direct Support and General Support Maintenance Repair
Parts and Special Tool List.

A-7. Shipment and Storage

TB 740-93-2 Preservation of USAMEC Mechanical Equipment for Shipment and Storage.
TM 740-90-1 Administrative Storage Equipment.

APPENDIX B

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

B-1. Scope

This appendix lists items which accompany the heater or are required for installation, operation, or operator's maintenance.

B-2. General

This Basic Issue Items List is divided into the following sections:

a. Basic Issue Items—Section II. A list of items which accompany the heater and are required by the operator/crew for installation, operation, or maintenance.

b. Maintenance and Operating Supplies—Section III. A listing of maintenance and operating supplies required for initial operation.

B-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items, section II.

a. Source, Maintenance, and Recoverability Codes (SMR).

(1) Source code, indicates the selection status and source for the listed item. Source code is:

Code	Explanation
P	Repair parts which are stocked in or supplied from the GSA/DSA, or Army supply system and authorized for use at indicated maintenance categories.

(2) Maintenance code, indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
C	Operator/crew

(3) Recoverability code, indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	Explanation
R	Repair parts and assemblies which are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
S	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically repairable they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High dollar value recoverable parts which are subject to special handling and are issued on an exchange basis. Such repair parts are normally repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high dollar value reusable casings or castings.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required. The abbreviation "w/e", when used as a part of the nomenclature, indicates the Federal stock number includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parenthesis. Repair parts quantities included in kits, sets, and assemblies are shown in front of the repair part name.

d. Unit of Measure (U/M). A 2-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit. This column indicates the quantity of the item used in the assembly group. A "V" appearing in this column

in lieu of a quantity indicates that a definite quantity cannot be indicated (e.g., shims, spacers, etc.).

f. Quantity Furnished With Equipment. This column indicates the quantity of an item furnished with the equipment.

g. Illustration. This column is divided as follows:

(1) *Figure number.* Indicates the figure number of the illustration in which the item is shown.

(2) *Item number.* Indicates the callout number used to reference the item in the illustration.

B-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies—Section III

a. Component Application. This column identifies

the component application of each maintenance or operating supply item.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the item name and brief description.

d. Quantity Required for Initial Operation. This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

e. Quantity Required for 8 Hours Operation. This column indicates the estimated quantities required for an average 8 hours of operation.

f. Notes. This column indicates informative notes keyed to data appearing in a preceding column.

Section II. BASIC ISSUE ITEMS

(1) SMR code	(2) Federal stock number	(3) Description		(4) Unit of meas	(5) Qty inc in unit	(6) Qty furn with equip	(7) Illustration	
		Ref No. & mfr code	Usable on code				(A) Fig No.	(B) Item No.
PC	7520-559-9618	TM 5-4520-233-14, Manual, Operator, Organizational, Direct and General Support Maintenance				1		
		Case, Maintenance and Operational Manuals				1		

Section III. MAINTENANCE AND OPERATING SUPPLIES

Item	Component application	Federal stock number	Description	Quantity required for initial operation	Quantity required for 8 hours operation	Notes
1		9130-160-1818	Gasoline, Auto, Combat MIL-G-3056, SPEC VV-G-76	6 gal	6 gal	Bulk
2		9140-286-5924	Fuel Oil, Regular (DF-2)	6 gal	6 gal	Bulk
3		9140-286-5286	Fuel Oil, Winter (DF-1)	6 gal	6 gal	Bulk
4		9140-286-5283	Fuel Oil, Arctic (DF-A)	6 gal	6 gal	Bulk

APPENDIX C

MAINTENANCE ALLOCATION CHART

Section I. Introduction

C-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function.

C-2. Explanation of Columns in Section II

a. *Group Number, Column (1).* The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from TB 750-93-1, Functional Group Codes) are listed on the MAC (Maintenance Allocation Chart) in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. *Functional Group, Column (2).* This column contains a brief description of the components of each functional group.

c. *Maintenance Functions, Column (3).* This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

- C — Operator or crew
- O — Organizational maintenance
- F — Direct support maintenance
- H — General support maintenance
- D — Depot maintenance

The maintenance functions are defined as follows:

- A—Inspect: To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.
- B—Test: To verify serviceability and to detect electrical or mechanical failure by use of test equipment.
- C—Service: To clean, to preserve, to charge, to paint, and to add fuel, lubricants, cooling agents, and air.
- D—Adjust: To rectify to the extent necessary to bring into proper operating range.
- E—Align: To adjust specified variable elements of an item to bring to optimum performance.
- F—Calibrate: To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.
- G—Install: To set up for use in an operational environment such as an emplacement, site, or vehicle.
- H—Replace: To replace unserviceable items with serviceable assemblies, subassemblies, or part.
- I—Repair: To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.
- J—Overhaul: To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.
- K—Rebuild: To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

d. *Tools and Equipment, Column (4).* This column is provided for referencing by code the special tools and test equipment, (sec. III) required to perform the maintenance functions (sec. II).

e. *Remarks, Column (5).* This column is provided for referencing by code the remarks (sec. IV) pertinent to the maintenance functions.

C-3. Explanation of Columns in Section III

a. *Reference Code.* This column consists of a number and a letter separated by a dash. The number references the T&TE (Tools and Test Equipment) requirements column on the MAC. The letter represents the specific maintenance function the item is to be used with. The letter is representative of columns A through K on the MAC.

b. *Maintenance Category.* This column shows the lowest level of maintenance authorized to use the special tool or test equipment.

c. *Nomenclature.* This column lists the name or identification of the tool or test equipment.

d. *Tool Number.* This column lists the manufacturer's code and part number, or Federal Stock Number of tools and test equipment.

C-4. Explanation of Columns in Section IV

a. *Reference Code.* This column consists of two letters separated by a dash, both of which are references to section II. The first letter references column (5) and the second letter references a maintenance function, column (3), A through K.

b. *Remarks.* This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, section II.

Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Functional group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
22	ACCESSORY ITEMS													
2202	Accessory Items													
	Connector power -----	--	--	--	--	--	--	--	O					
	Connector thermo -----	--	--	--	--	--	--	--	O					
	Thermostat room -----	C	O	O	C	--	--	--	O	--	--	--	1-B	A
2210	Data plates -----	--	--	--	--	--	--	--	O					
42	ELECTRICAL EQUIPMENT													
4201	Transformer (power) -----	--	O	--	--	--	--	--	O	--	--	--	1-B	B
4202	Electrical Controls -----	--	O	--	--	--	--	--	O	--	--	--	1-B	C
4203	Circuit Breakers: -----	--	O	O	--	--	--	--	O	--	--	--	1-B	D
	Fuse and fuse holders -----	--	--	--	--	--	--	--	O					
4206	Thermostatic, Automatic & Manual Control Devices -----	O	O	O	--	--	--	--	O	--	--	--	---	E
4209	Signaling Devices -----	--	--	--	--	--	--	--	O				---	
4216	Misc Wiring and Fittings -----	--	--	--	--	--	--	F	F	--	--	--	---	F
60	HEATERS													
6001	Case Heater -----	--	--	O	--	--	--	--	--	F	--	--	---	G
	Deflector hood -----	--	--	--	--	--	--	--	O				---	
6004	Fuel System													
	Filter, fuel -----	--	--	O	--	--	--	--	O	--	--	--	---	H
	Pump, fuel -----	--	--	O	--	--	--	--	O	--	--	--	---	I
	Lines and fittings -----	O	--	O	--	--	--	--	O	--	--	--	---	J
	Carburetor -----	O	--	--	O	--	--	--	O	--	--	--	---	K
6005	Burner Assembly													
	Burner assembly -----	O	--	O	--	--	--	--	O	--	--	--	---	L
	Igniter -----	O	--	O	--	--	--	--	O	--	--	--	---	M
	Transformer, igniter -----	O	O	O	--	--	--	--	O				---	
6006	Motor Assembly													
	Motor combustion -----	--	--	--	--	--	--	--	O	F	F	--	---	O
	Motor air circulating -----	--	O	--	--	--	--	--	--	O			---	
6013	Heat Exchanger -----	F	--	--	--	--	--	--	F	--	--	--	---	P

Section III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

Reference code	Maintenance level	Nomenclature	Tool number
1-B	O	MULTIMETER	6625-543-1438

Section IV. REMARKS

Reference code	Remarks
A-B	Test for electrical continuity.
B-B	Test transformer for malfunctioning.
C-B	Test electrical controls for malfunctioning.
D-C	Clean thermocouple.
E-B	Test preheat and overheat thermostat for malfunctioning.
F-I	Fabricate electrical leads.
G-I	Weld heater case.
H-C	Clean filter.
I-C	Clean filter.
J-A	Inspect for leaks.
K-D	Adjust fuel adjustment needle and inspect screen.
L-A	Inspect air hose for cracks and signs of deterioration.
L-C	Clean and inspect burner housing for cracks.
M-C	Clean igniter plug.
O-I	Repair consists of replacement of brushes and capacitor.
P-A	Inspect heat exchanger for cracks, and broken welds.

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